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Bovine Trichomoniasis in Great Britain

[The Ministry of Agriculture has recently made an enquiry, through its Divisional Inspectors, as to the incidence of non-scheduled diseases, with particular reference to trichomoniasis. Reports indicated that this disease is much more widespread than is generally believed and, in consequence, the following statement has been prepared, dealing not only with its distribution, but also giving guidance to practitioners on diagnosis and treatment.]

Bovine Trichomoniasis in Great Britain

Distribution and Incidence

As many veterinarians in Great Britain are aware, the Ministry of Agriculture and Fisheries recently made certain enquiries throughout the country with a view of ascertaining, as far as possible, the distribution of bovine trichomoniasis and the severity of the losses caused by it. It appears to be generally agreed that in all parts of Great Britain sterility and abortion rank very high among the causes of loss in herds, and although ordinary contagious abortion is undoubtedly responsible for a large majority of the actual cases of abortion that are observed, and for various other ill-effects which may accompany or follow abortion, it has long been known that there is at least a significant amount of disease, associated with disturbance of the breeding functions, that cannot be attributed to the presence of *Brucella abortus*. It therefore seemed desirable to direct special attention to the occurrence of infections transmitted mainly or entirely by coitus, and in particular to the distribution and incidence of bovine trichomoniasis. The summary which follows is based on the information supplied to the Ministry's Divisional Veterinary Inspectors by practitioners, supplemented by the data furnished by the various laboratory organisations.

In ENGLAND it appears that the disease has been definitely diagnosed in 21 counties, comprising Yorkshire (West Riding), Lancashire, Cheshire, Derbyshire, Lincoln, Suffolk, Cambridge, Stafford, Shropshire, Gloucester, Oxford, Buckingham, Kent, Sussex, Berkshire, Hampshire, Wiltshire, Somerset, Dorset, Devon and Cornwall. In all but two of these counties, positive diagnoses made in the field have been confirmed by laboratory workers.

There are also reports of suspected outbreaks in a further eleven counties, *viz.*, Cumberland, Westmorland, Nottingham, Norfolk, Leicester, Northampton, Worcester, Bedford, Hertford, Essex and Surrey. In these outbreaks such examinations as were made failed to reveal the presence of *Trichomonas foetus* but it must be recognised that one or two negative observations are in no way conclusive and that the value of many of the examinations made in laboratories was seriously lessened by the length of time which necessarily elapsed between the taking of the material and its receipt at the laboratory.

In WALES positive diagnoses have been recorded from five counties, comprising Anglesey, Denbigh, Flint, Carmarthen and Monmouth, and in connection with outbreaks in the first three of these counties the diagnosis has been confirmed by laboratories. Suspected outbreaks which were not definitely diagnosed have occurred in a further two counties, Caernarvon and Glamorgan.

In SCOTLAND only one outbreak, which occurred in Ayrshire, appears to have been diagnosed by a laboratory worker, and positive diagnosis in the field has been recorded only from Argyll and Berwickshire. Suspected outbreaks, not definitely diagnosed, have occurred in six counties, *viz.*, Shetland, Banff, Moray, Nairn, Aberdeen and Dumfries.

From the information available at present, therefore, it appears that the disease probably occurs or has recently occurred in approximately three-quarters of the counties of England and one-half of the counties of Wales, but in only one-quarter of the counties of Scotland. It may well be that it occurs far more widely than has yet been suggested.

The distribution of the infection, as a knowledge of the usual mode of transmission would lead one to expect, appears to be quite irregular and patchy. The disease is particularly liable to cause severe outbreaks on groups of small farms, where communal bulls are used or there is much movement of animals for breeding purposes between the different small herds, but it may also occur in large herds which are mainly self-contained and in them cause serious disorganisation of the breeding programme, with a consequent check in the production of milk and calves and serious monetary loss.

The distribution may also change very considerably within a year or two. In an infected herd or group of herds the losses decline, sometimes rapidly, as a result of the energetic execution of suitable prophylactic and curative measures, and sometimes much more slowly, where treatment is less thorough and suitable. It appears that the infection may tend to recede and eventually to disappear, even in the absence of effective treatment, but in such conditions the course of the outbreak may be much protracted and the losses very heavy. As the disease abates in one area the movement of infected animals may cause its appearance in other and possibly distant areas, and the spread of infection in the new centres may be rapid, but sometimes is at first slow and insidious.

In some of the counties mentioned as infected, the disease has been diagnosed on a number of farms and in several different districts, but in some other counties it has been recognised only on one or two farms. The largest outbreaks yet recorded in Great Britain occurred in 1938 in Holy Island, off the coast of Anglesey, and subsequently in the adjoining parishes of Anglesey itself. The energetic measures then taken and active propaganda led to the abatement of the disease and a very great improvement. The results of the recent enquiries would suggest that the chief centres of the infection in England during recent years have been situated in Cheshire, Shropshire, Oxfordshire, Somerset, Wiltshire and Hampshire.

The available information is obviously very incomplete, however, and it cannot be regarded as revealing the full extent and distribution of the disease, nor as giving any reliable indication of the main centres of infection at the present time. Single outbreaks as extensive as that which occurred some years ago in Anglesey naturally attract serious attention and they may not occur very commonly, but where farming conditions differ from those prevailing in Anglesey the local distribution of the disease will show corresponding variations, and the real extent of the outbreaks and the full measure of the losses may not be at all easily appreciated. The fact that up to the present time more outbreaks have been recorded in certain counties or areas than in others may have no particular significance, and may indicate merely that for one reason or another more attention has been paid in those areas to the problem of differential diagnosis. Most of our knowledge of this condition has been acquired only in recent years and not all practitioners are familiar with the characters of the disease and prepared to undertake its microscopic diagnosis with confidence. It has further to be recognised that, according to the severity and character of a particular case and the stage at which it is examined, microscopic diagnosis may be accomplished very easily and quickly or it may prove a matter of some difficulty, and it is likely to be particularly difficult, or even impossible, if treatment by antiseptic irrigations has already been instituted. Moreover, failure to demonstrate trichomonads in material sent to a laboratory can never establish a negative diagnosis, although a positive diagnosis made in such conditions is of course conclusive. A negative diagnosis may merely indicate that the material was not sufficiently fresh when examined at the laboratory, or that it was in some way unsuitable, or taken at an unfavourable time. It appears that differential diagnosis is by no means always attempted, however, and that cases of sterility or early abortion, associated with vaginitis or metritis, may be treated by irrigations, etc., without any attempt being made to establish the exact nature of the local infection.

In spite of our imperfect knowledge at the present time of the distribution of the disease and as to its relative importance, there are indications that its distribution is probably far wider than has yet been recognised and that the losses caused by it are of real significance. It is highly desirable that every effort should be made to identify the causes of all outbreaks of sterility and abortion. Exact diagnosis is a valuable guide to suitable lines of curative treatment: in connection with prophylaxis, a matter of at least equal importance, it is the only reliable means of ensuring the choice of those measures that are most likely to prove effective.

Diagnosis

1. Clinical

The clinical descriptions of bovine trichomoniasis, as recorded by different writers, show very considerable variations in detail, and it appears that not only may the infection run very different courses in different outbreaks or individuals, but also that the clinical picture may be greatly modified by a variety of concurrent or secondary infections.

In general it may be said that the possible occurrence of trichomoniasis should always be suspected:—

(*a*) When several cows or heifers repeatedly "return to service." After service the return of oestrus may first be seen after three weeks, but much more commonly after 6, 9 or 12 weeks;

(*b*) Where abortion occurs at an early stage of pregnancy—commonly between the sixth and sixteenth weeks (abortion from this cause has been observed in the second half of pregnancy, but this appears to be a rare occurrence);

(*c*) In cases of endometritis or pyometra, associated with anoestrus;

(*d*) In cases of vaginitis and cervicitis.

It should be emphasised that cases of abortion may never be observed or suspected, and the only trouble reported by the owner or attendant may be a failure to conceive in spite of repeated service.

On the other hand a cow is often believed to have "held to service," and may appear to be quite normal for a period of from two to four months, or even five months or longer, until the disease is revealed by the appearance of a clear discharge from the vulva. Examination *per rectum* at this time will probably show the size of the uterus to be approximately that which would be expected, having regard to the date of service, but, as recorded by Gould (*Vet. Rec.*, February 27th, 1937) the ovaries often contain no palpable corpus luteum.

With respect to discharges from the vagina and vulva, there is usually some discharge at certain stages of the infection, and it may be abundant, but it is often very scanty and may hardly be noticeable. In such cases it is commonly more abundant at the time of oestrus. The occurrence of a clear, colourless, mucoid discharge, or of such a discharge containing whitish streaks or flakes of pus, is considered characteristic, but in addition to the fact that it may be extremely scanty, it is also necessary to remember that its characters may be altered by intercurrent or secondary infections.

There may be obvious signs of vaginitis and cervicitis, and some authors have described as very characteristic a granular appearance of the vaginal wall, produced by enlargement of the lymph follicles and associated with a roughened feeling to the touch which has given the condition the name of "rasp" or "greater vagina." It is often impossible to detect such a condition, but when it occurs it is always very suggestive, although probably not diagnostic. On the other hand, in many cases there are no definite signs of vaginitis, and acute or severe vaginitis is probably never directly caused by *Trichomonas foetus*, but rather by some other organism, occurring either independently or in association with the trichomonads. In particular, it appears that the occurrence within one or two days of service of signs of acute inflammation in the vulva and vagina is commonly due to the virus of vesicular exanthema, but that disease is often associated with trichomoniasis, and the subsequent occurrence of early abortions, or of sterility persisting for several months or longer, may be taken to indicate the probable existence of such an association.

In a recently infected bull there may be a muco-purulent discharge from the prepuce, and the mucous membrane of the penis may show reddened nodules, but the preputial secretion may be very scanty and although still infective, a bull may show no definite symptoms at all. Any acute or severe local inflammation in the bull is probably due to some other cause, although that cause may be associated with, or perhaps secondary to, a trichomonad infection.

It should be noted that a bull is not proved to be free from infection, or at least non-infective, by the fact that some of the cows served by him may carry to full term and calve normally. In some instances practically all of the cows and heifers served by an infected bull develop symptoms of infection in one form or another, but in other cases a proportion of the animals (and it may be quite considerable) pass through a normal pregnancy and parturition, and may show no signs of infection. It has been shown experimentally that in some cows and heifers the infection is quickly overcome and eliminated, but it is also known that some animals will carry to full term and calve normally, in spite of the fact that infection with *Trichomonas foetus* is still present. Such animals are particularly dangerous, inasmuch as they may pass on the infection to a clean bull, but are not readily suspected.

It appears that the clinical picture of trichomoniasis may show very considerable variations, often accentuated by the association of the disease with concurrent or secondary infections, and there is probably no symptom which can be regarded as pathognomonic. On the other hand there are many symptoms, or combinations of symptoms, which should arouse suspicion of the possible or probable occurrence of the infection and indicate the need of suitable microscopic (and if necessary cultural and serological) examinations.

A point of particular importance, in connection with the differential diagnosis of trichomoniasis, is the possible association of that disease with the common form of contagious abortion. It is generally accepted that infection with *Brucella abortus* is responsible for the great majority of bovine abortions, occurring most commonly in the second half of pregnancy, and that, mainly indirectly, it may lead to serious changes in the uterus and ovaries and to sterility. It is equally well known, however, that *Brucella* infection may exist in a herd in a relatively quiescent form, that some infected animals do not abort at all, and that many abort only once and thereafter may show no signs of impaired fertility. Having regard to the wide distribution of the infection, it is to be expected that a very considerable proportion of the herds into which *Trichomonas foetus* may be introduced, will already be infected with *Brucella abortus*, and that the two infections will often coexist. The existence of *Brucella* agglutinins in the blood of the infected animals, although proof of infection with *Brucella*, cannot, therefore, be taken to exclude *Trichomonas foetus* as the possible cause of some or even most of the breeding troubles experienced in a herd at a particular time. It is necessary to consider the history and all the characters of the outbreak, and if these characters resemble those commonly associated with trichomoniasis, suitable microscopic examinations should be made. The matter is one of some practical importance, having regard to the differences between the two infections in relation to their mode of spread and the prophylactic and curative measures likely to prove effective.

2. Microscopic

(*a*) *Collection of the Sample.* The first step is the collection of discharge from the vagina, and it is important, first, that it should be taken before any local injections or irrigations are practised and, secondly, that it should be free from contamination with material from outside the genital tract, and particularly faeces. Such contamination would be undesirable from several points of view, but it must particularly be remembered that faecal material might contain *Trichomonas ruminantium*, a common parasite of the alimentary canal which might easily be mistaken for *T. foetus*. If necessary, the external parts should be washed, and the material should be taken from an area well within the passage. Should the discharge be scanty, or should an immediate examination of the first sample fail to reveal trichomonads, it is highly desirable that material should be obtained from the vicinity of the external orifice of the cervix, which appears to be a predilection site of the organism. The use of a speculum will, of course, facilitate this, and the discharge is best removed by aspiration with a pipette (with a smooth, rounded end) to which a rubber bulb has been attached. Where the discharge is very scanty, it may be an advantage to fill the pipette with normal saline solution or Locke's fluid, project this on to the mucous membrane and re-aspirate the fluid from the vaginal floor. This "washing" of the mucosa may be repeated several times before the fluid is finally transferred to a suitable stoppered tube or bottle. (A special, but simple pipette, conveniently adapted to this "washing" operation, has been described by Andrews and Miller in the *American Journal of Hygiene*, volume 27, 1938.) In the majority of cases, however, suitable material can be obtained by the use of a cotton-wool swab, moistened with normal saline solution, but if microscopic examination is not to be carried out immediately, the swab should be washed off in a small quantity of saline solution, or placed in a tube containing sufficient saline to keep it moist. If the further examination is likely to be delayed, as when the material is to be forwarded to a laboratory, it is sometimes recommended that a *few* drops of Lugol's iodine should be added to the liquid.

In some cases of uterine infection it appears that the trichomonads are not established in the vagina, and that they are present in the passage only at certain times, when discharge is expelled from the uterus. When the organisms cannot at once be demonstrated in the vagina, it is, therefore, desirable, if possible, to collect discharge from the uterus itself. In those infrequent cases in which abortion is actually observed and the aborted foetus is found, the foetal membranes, if sufficiently fresh, will usually provide favourable material for examination; the organisms have also been found in the foetal stomach and in other organs.

The diagnosis of the disease in the bull requires the examination of discharge from the prepuce, and the material should be taken, with the aid of a swab, from the folds and crevices in the mucous membrane.

(*b*) *Microscopic Examination.* It is important to examine the material as soon as possible after it has been removed from the animal, and where such a procedure is practicable it is best to carry out microscopic examination on the farm. This may permit a microscopic diagnosis to be rapidly and easily made, and, moreover, if the first sample is negative, it will allow the veterinarian at once to take further and possibly more favourable samples. Dried and stained preparations are not satisfactory for the purpose of diagnosis, although such preparations can be obtained, if desired, from material found to contain numerous trichomonads. The fresh material should always first be examined in a moist condition and unstained, although some workers have found it advantageous to add to it a very small amount of eosin solution (one drop of 2 per cent. eosin on the slide), the unstained trichomonads showing up well against the stained background. The material under examination may be in the form of a "hanging drop," a method which requires the use of a special slide with a "well" or depression ground in the centre of one surface, but a special slide is really unnecessary, and satisfactory results are obtained by placing a drop of the material in the centre of an ordinary clean slide and covering it with a thin coverslip.

The most satisfactory light for the examination is provided by adjusting the mirror of the microscope in such a manner as to obtain maximum illumination of the specimen, and then cutting down the light, by narrowing the aperture of the iris diaphragm, until the edges of objects are thrown into fairly sharp relief. With respect to magnification, it is best to examine the preparation first under a $\frac{2}{3}$-inch (or 16 mm.) objective, noting evidence of movement in the material, and then to select and centre a promising field, fix the slide, and examine the field under a $\frac{1}{6}$-in. (or 4 mm.) objective. With this magnification it is possible to see all the characters that are necessary for the purposes of diagnosis, although more detail can naturally be observed with the use of a 1-12th in. immersion lens (it is perhaps well to point out that, except in practised hands, very great care is required in using a high-powered oil-immersion lens for the examination of unstained material).

Of all the characters of *Trichomonas*, the most important for its recognition is its motility. In the absence of motility it is not merely much more difficult to form a definite conclusion as to the nature of the organisms: it may be very difficult, or even impossible, to find them at all. It is particularly for this reason that any delay in the examination of specimens is highly undesirable, and that negative diagnoses at laboratories, based on the examination of stale material, have little significance. It is desirable, as far as practicable, to keep the material warm between the time of its collection and that of its examination, and if the weather is cold, and on examination movement in the specimen is found to be absent or very feeble, it may sometimes be restored by gentle warming of the material for some hours. The rate of movement depends on the age of the specimen and the state of the organism, and also on the temperature and consistence of the medium in which the organisms are moving. Fresh, vigorous organisms swim very rapidly if suspended in a thin discharge, and should be seen to move actively about the microscopic field, but their movements (and consequent displacement in the field) become much slower and even sluggish as their vitality declines in an ageing or cooling specimen, and even in fresh specimens their movements may be comparatively slow and much restricted, when they are suspended in a very thick discharge containing much mucus. The actual nature of the movement, or the working of the locomotive apparatus, can be observed better in an ageing preparation, when movement is rather sluggish and displacement in the field is slow.

Having picked out the organisms by their motility, it is important to note their size and shape. With respect to size, the trichomonads may show some considerable variations, but they are rather larger, at least in their long diameter, than the polymorphonuclear leucocytes usually present, and smaller than the epithelial cells commonly found in vaginal discharge. Their most usual forms have been described as pear-shaped, leaf-shaped and egg-shaped, and they have been compared with flat-fish, but they may be more oval or almost spherical in form.

Projecting from the anterior end of the body there are three flagella, approximately as long as the body itself, and one flagellum arises near the anterior end and passes back along the length of the body, to project beyond the posterior extremity. For much of its length this posterior flagellum borders an undulating membrane, by which it is attached to the body. These details cannot be seen clearly in living, unstained specimens, but when the movements are not too rapid and vigorous it is possible to make out the lashing action of the flagella, and the characteristic movement of the undulating membrane along the length of the body. When motility is greatly reduced and the organisms are dying out, it is often possible still to observe the movement of this membrane, although no other movement may now be evident. In general it may be said that the trichomonads, once seen and examined, are very easy to recognise, but it might be advisable for one who is rather inexperienced in microscopic work, or who has for some years had little occasion or opportunity to practise it, to seek first the aid of a more experienced worker in this field and if possible to obtain a demonstration.

Although trichomonads, if found while still living, are identified with ease, however, they may be found only with great difficulty. As a rule they are abundant, and, therefore, found and identified with ease, in discharge taken from the vagina (in a good case) a few weeks after the infection has been contracted or very shortly after an actual abortion has occurred, and also in pyometra material. On the other hand they may be present in very small numbers, and found only after prolonged search, in vaginal and uterine discharge, and they are usually scanty in preputial discharge from the bull. In some cases they cannot be found at all, at the particular time of examination, although at a later date they may appear, or reappear, and may even be abundant. Examination of bulls known to be spreading the infection quite frequently fails to reveal the organisms.

In the especially favourable conditions of experimental work, and with the aid if necessary of repeated examinations, it is possible to find the trichomonads in practically all of the infected cows and heifers, and, with greater difficulty, in most of the infected bulls. In the conditions of practice this is not possible, but the diagnosis can often be made with ease, and where difficulty is encountered it is advisable at least to make several examinations. An oestral period appears to be the most favourable time for examination in difficult cases; some workers consider the beginning of oestrus to be most favourable but others recommend examination on the second day of the period, when the cervix has usually relaxed.

It is evident that, in the ordinary conditions of practice, microscopic examinations cannot be relied upon to identify every infected animal, but for practical purposes such an identification, although desirable, is not essential. The matter of real importance is the diagnosis of the condition affecting the *herd*, and this can practically always be done by direct examination, repeated if necessary, of the more favourable cases. Where any considerable difficulty is experienced in arriving at a diagnosis, it has been recommended that particular attention should be paid to heifers which have recently been served, the most favourable period for examination extending from about two to six weeks after service.

3. Cultural

In some instances trichomonads have been successfully cultivated from vaginal or uterine discharges, although direct examinations have failed to reveal them. Any practitioner who might wish to avail himself of this further aid should arrange the matter with a laboratory, and the laboratory would naturally supply tubes containing the selected medium and any special instructions.

4. Serological

Several investigators have reported favourably on a complement-fixation test for trichomoniasis, but it has not been employed extensively, or as a routine test. In recent years Dr. Muriel Robertson, at the Lister Institute and the Institute of Animal Pathology, Cambridge, has studied the development of serum agglutinins for *Trichomonas*, and Dr. Robertson and Mr. W. R. Kerr, of the Veterinary Research Division, Stormont, Northern Ireland, have applied an agglutination test with some success to the diagnosis of trichomoniasis in cattle. They stress the limitations of the test, and it seems that positive reactions have always been found to indicate the presence (or recent presence) of infection, but that infected animals do not necessarily react positively, and a negative reaction does not imply freedom from the infection.

It appears that the test may render valuable service in establishing the presence of infection in the *herd*, but that sera from a number of animals should always be submitted to examination, and the test should not be relied upon to reveal the infected individuals. Any practitioner wishing to submit sera for serological examination should communicate with Dr. Robertson at the Institute of Animal Pathology, Cambridge.

Treatment

1. Curative

The curative treatment of cows and heifers is practised with a large measure of success, and it appears that the infection can be eliminated in practically all cases. In a proportion of the

animals the breeding capacity is impaired or even permanently lost, in spite of the fact that they have been rendered non-infective, and that trichomonads can no longer be demonstrated in the genital tract. It appears that in these cases the disease has been allowed to progress too far, causing irreversible changes in the tract, and it is obviously desirable to institute treatment at as early a stage as possible.

Various agents, including 1:1,000 chinosol, have been used with success for irrigations of the uterus and vagina, but it appears to be fairly generally agreed that iodine solutions have proved effective and are to be recommended. In Northern Ireland, Kerr and Lamont have obtained good results with concentrations of 1-400 and even 1-200, and the Survey Committee of the N.V.M.A. has recommended the use of a solution obtained by adding 2 drachms of liquor iodi aq. and 30 minims of lactic acid to 12 ounces of warm water. It is advised by the Survey Committee that weekly irrigation should be carried out until oestrus recurs spontaneously and the abnormal discharge markedly diminishes or disappears, this usually occurring after two or three irrigations. A week after the recurrence of oestrus a further uterine irrigation with the iodine solution (but omitting the lactic acid) should be given, and this should be repeated a week later if abnormal discharge is still noted. The animal is considered to be fit for service after normal oestrus, unaccompanied by any abnormal discharge, has returned on two consecutive occasions.

In cases of pyometra, expulsion of the corpus luteum, if present, and ovarian massage have been recommended, and it is stated that this treatment alone may not only bring about the recurrence of oestrus, but simultaneously promote the expulsion of the uterine contents and clearing up of the uterine infection. The treatment should be supplemented, however, by uterine irrigation on the lines already mentioned.

The treatment of infected bulls has been found by most workers to be a protracted and rather uncertain matter, the treated animal often remaining infective, and it is generally advised that infected bulls should be slaughtered, although, with some treatment, they may sometimes be retained for a time for use with cows known or suspected to have been exposed to infection. The ineffectiveness of ordinary treatment appears to be due to the presence in the preputial mucous membrane of folds and flask-like crypts in which the trichomonads may lurk, and so escape the action of antiseptic irrigations of the preputial sac.

Abelein has reported very successful results in the treatment of infected bulls, but his method requires that the bull should be cast and the penis withdrawn under epidural anaesthesia (with tutocaine); where difficulty is experienced in withdrawing the penis and everting the sac, Abelein has used an improvised suction pump. An assistant exposes the preputial mucous membrane by gentle traction on the penis, and the operator (wearing rubber gloves) smoothes out the membrane and thoroughly massages into it, with gentle pressure, a 0·5 per cent. ointment of trypaflavine (or euflavine), paying particular attention to the many folds and crevices near the urethral opening. About 30 c.c. of a 1:1,000 solution of trypaflavine (or euflavine) is then injected into the urethra, and the penis is returned to the sheath; the opening of the prepuce is covered with the ointment and is then tied with a string which is left in position, to prevent the protrusion of the penis, until anaesthesia has passed off. The treatment is repeated about a week later. Acriflavine may, of course, be employed instead of trypaflavine, but is rather more irritant.

By the use of this method Abelein claimed to have cured 55 out of 57 bulls, and it appears that the method is usually very effective but not quite certain. Having regard to the difficulty and expense of the treatment, and the importance of eliminating the infection with the greatest possible approach to certainty, the method would appear to be unsuitable for general adoption, but it may deserve serious consideration in connection with a bull of exceptional value.

2. Preventive

Although the curative treatment of infected cows and heifers is an important matter, the most valuable service that the veterinarian can render is the prevention of the further spread of the infection within the affected herd, and from that to other herds.

Immediately the existence of the disease is suspected, all breeding operations should be temporarily suspended, and steps should be taken to establish the diagnosis. The breeding records should be examined, and an attempt made as soon as possible to recognise the extent of the infection in the herd, and to assign the individual animals to one of three categories, *viz.*, non-infected, infected and suspected. The records may give strong evidence that the infection has been mainly or even entirely spread by one particular bull, but in many cases a cow or heifer which has failed to "hold" to the infective bull will subsequently have been put to another bull, which must, therefore, be regarded with suspicion.

It is usually safe to assign all of the virgin heifers to the non-infected group, but nevertheless these animals should be examined, and the veterinarian should enquire whether any abnormal discharges have been observed at any time in any member of this group. It appears that coitus, although the usual, is not quite the invariable mode of transmission, and there is some evidence that infection has occurred in virgin heifers, although the occurrence appears to be extremely rare.

Animals which appear to be passing through a normal pregnancy must be regarded with suspicion, as in some or even most of them the sudden return of oestrus, the appearance of a discharge or the occurrence of abortion may at any time reveal them to be infected. Even those which carry to full term and calve normally can be accepted as uninfected only if their breeding history is satisfactory, and shows no contacts with any bull believed to have been infected at the time, and subject to a negative result from microscopic examination of the discharges after parturition.

The steps taken to separate the infected animals should include microscopic examination of all discharges as such an examination, although failing to detect all of the infected, will at least reveal many of them and in particular will reveal those which are most actively spreading the infection.

When separation has been secured as effectively as possible, the infected cows and heifers should be treated, and breeding operations may then be resumed in the non-infected section, a new bull, free from all suspicion of infection, being provided for the virgin heifers and for the older animals believed on good grounds not to have been exposed. A bull which is believed to have been infected or to have been exposed to infection, should never be used for animals in the "clean" section, unless an animal of quite exceptional value is concerned and it has been subjected to Abelein's treatment, with careful subsequent examinations for any signs of infection (and even then its use at first should be very restricted, and the results carefully observed).

It is sometimes recommended that both cows and bulls should be douched prior to service, and the bulls again douched after service, but some experienced workers are not in favour of this procedure. Prophylactic treatment of bulls in this way would appear to be desirable when communal bulls are employed in a number of small herds.

With respect to general hygiene, it would appear that the trichomonads will survive for only a comparatively short time outside the animal body, and that the risk of the contraction of infection by contact with contaminated floors, walls, etc., is very small indeed. It is obviously desirable that no risks of this kind should be accepted unnecessarily, however, and that all infected discharges should be destroyed and contaminated stables cleansed and disinfected.

Ministry of Agriculture and Fisheries.

October, 1942.

MILK DISTRIBUTION AND QUALITY

The Minister of Food, in a recent statement on milk distribution, hailed October 1st as "a very important stage: the Government became the owner of the nation's milk, and responsible for the direction of distribution."

What happened on October 1st was that contracts between individual producers and buyers were cancelled, and now producers sell to the Milk Marketing Board, which sells to the Ministry of Food, which sells to the distributors. Lord Woolton said that it was untrue that the Ministry was taking over the Milk Marketing Board.

In view of complaints about the present quality of milk, special interest attaches to the Minister's announcement that the Ministry of Agriculture, in association with the marketing board, the Ministry of Food, and the distributors, is setting up a testing scheme, which, he said, he was sure would have beneficial effects. [Full particulars of this scheme were published in our issue of September 19th—page 384.—*Editor.*]

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ROYAL ARMY VETERINARY CORPS

The following announcement is made in the issue of *The London Gazette* dated September 25th, 1942: Norman Macgillivray Black (244420) to be Lt. September 4th, 1942.

"Cramp" in Racing Greyhounds*

HAMILTON KIRK, M.R.C.V.S.
London

As the official veterinary surgeon to a London greyhound racing stadium for the past 15 years, I have been sorely exercised, at times, to account for the incidence, whilst racing, of "cramp" in greyhounds which could and should be regarded as in good health and fit racing condition. The cases, whilst mainly of sporadic occurrence, occasionally seem to be almost epizootic.

It is disconcerting, to say the least, for one who has to furnish an official explanation for such occurrences, to watch a dog start hot favourite, and then tail off half way round the course and finish in the prone position, probably having to be carried off the track by an attendant. Spectators, whose money is at stake, are apt to jump to erroneous conclusions, and make wild allegations against the trainers, the kennel boys, or even the management.

For the first time in 15 years I recently took a "busman's holiday" and actually visited another track as an onlooker. I was advised by friends that a certain greyhound was a "racing certainty." It could not be beaten! I was induced to back it "with the field." I did not foresee that "cramp" might put a sudden end to my aspirations; but such was the case, and the unbeatable dog was duly carried off—as was my money. Afterwards I had a long and earnest chat with the officiating veterinary surgeon and he admitted being quite unable to explain that and similar occurrences.

Here was a dog apparently in tip-top condition and entitled to win on his past performances; and the suggestion that the dog had been "interfered with" was entirely ruled out by a number of circumstances.

Long before, but particularly since, that incident I have pondered much over the aetiology of "cramp," and eventually came to the conclusion that it might throw some light on the matter and help track veterinary officials if I enumerated such causes of "cramp" as occur to me.

Nature of the Attacks.—For the information of those members who have no experience of greyhound racing, it may be said that "cramp," as affecting greyhounds, is manifested as follows: In a mild attack the affected hound commences to trail behind the others and then rapidly loses ground. His gait is wooden and when he finally walks in he is hardly able to drag one hind leg before the other.

"Drag" is an apt term to use for, in slow progression, it is noticed that both hind legs are dragged forwards on the superior surface of the digits, these being knuckled under.

On close examination one finds the muscles of the loins and hindquarters are hardened (and these appear to be the only muscles implicated); the dog stands like a wooden animal, looks distressed, usually cyanotic, and after periods of rest and massage ranging from 5 to 15 minutes he recovers completely.

In severe cases the dog actually falls down during racing, struggles and rolls on the ground, and has to be carried off. Unlike "cramp" occurring in humans, such as so frequently happens whilst they are in bed, and apparently without any provocation, "cramp" in the dog appears not to occasion pain; at least, the animal does not cry out.

It is, in fact, a hind-limb tonic rigidity in which the limbs—far from being contorted or drawn up to the body—are fully extended.

Aetiological Factors

1. Fatigue.—Such tonic muscular spasm, or rigidity, is indicative of an irritative lesion, functional or organic, in some part of the motor tract, or a morbid irritation in the muscular substance. But prolonged or severe muscular exertion may soon bring about a state of muscular fatigue which occasions, in some individuals, a tonic muscular spasm. This can occur in animals which, otherwise, are in the best of health.

But the *actual* cause of fatigue is an accumulation in the muscle of the chemical products of contraction. The chief product, as pertains to muscle, is sarcolactic acid. That its accumulated presence actually does occasion fatigue has been experimentally proved by observing the effects of passing a solution of this acid directly into one or more muscles. Further, that by washing out such muscles with a little weak alkali the power of contractility is restored and the sensation of fatigue departs. Working muscles are normally protected from fatigue by the circulating blood which carries off the waste products of their activity. It would appear, then, that resistance to fatigue is dependent upon the proper working of the respiratory and circulatory systems. In fact, one may say that severe or prolonged muscular exertion could not be sustained unless an adequate supply of oxygenated blood was sent to the muscles. This, in turn, necessitates a rapid flow of blood and adequate ventilation in the lungs, with strong regular pumping of the heart. In other words, we are dealing with that illusory state of health known as "condition," a state of perfection which can only be achieved by regular and progressive exercise, careful feeding and good general management.

Any man or animal having attained top "condition" would be able to withstand severe exertion without fatigue; but, as some writers have stated, such high "condition" can rarely be maintained for long. They have even recorded that it is easy, in the training of horses, to overstep the mark and produce "staleness," a result which—like the fatigued muscle—is usually recovered from by a short judicious rest to which the system immediately responds. Whilst it is true that good "condition" is judged largely by the state of the muscles, it should not be forgotten that the ability to endure violent exertion is far more dependent on the respiratory and cardiac mechanisms having been trained than on the skeletal muscles. Long walking exercise is given as a muscle developer, and judicious gallops to give the animal its "wind"; yet, as a matter of fact, the "wind" is largely a question of heart.

"Cramp" during racing may arise, then, purely as a result of fatigue. How is this to be prevented? By a special education of the muscles for the particular class of work required, and the only way in which this education can be effected is by training. The art of the trainer lies in employing a suitable resistance, gradually and skilfully increased, and it requires long practice and experience. The veterinary surgeon can assist, as the pulse, temperature and respirations are an unfailing guide to the progress made. The rates of pulse and respiration may be taken before work, again immediately on cessation, and again five minutes after cessation of work. Daily or weekly comparisons, made as the time goes by, will reveal at once what progress is being made.

2. Defective Heart Action.—Whilst tonic muscular contraction or "cramp" may occur without any cardiac responsibility, and because the muscles themselves are incapable of responding to too violent or prolonged work, it must not be forgotten that cardiac disabilities of various kinds may mean the failure to provide an adequate circulation to the skeletal muscles with the same end result.

The "cramp" from such cardiac weakness under severe stress is accompanied by considerable general distress, dyspnoea and cyanosis.

Auscultation of the heart must be undertaken for the detection of organic defects; and it is quite useless to conduct such an enquiry just after racing, when the animal is distressed. Such examination can only usefully be carried out when the dog is absolutely quiet and unexcited.

The mere act of examination will often send up the pulse rate and one must wait until the animal is subdued.

In an investigation as to the cause of the "cramp," therefore, it is imperative that the heart action, as well as the *nature* of the pulse, be ascertained before making out a report.

In passing, one may mention that the filling of the heart is a question of venous inflow. If more is being returned than the ventricle can get rid of, it accumulates in the auricle, and when animals are raced to death it is the auricle which ruptures—generally the right—owing to the resistance offered by the congested condition of the lungs.

3. Muscle Toxins.—"Cramp" and tetany may be caused by chemical or bacterial poisons, and it is under this heading that one might usefully make enquiry should there be any suspicion that some unscrupulous person might have interfered with a dog. It is only fair to say, at the outset, that under the careful supervision enforced on the duly licensed tracks, such an attempt, or the opportunity for it, would only rarely, and with difficulty, occur. Nevertheless one does occasionally meet the doggy expert who loudly proclaims his "extensive veterinary knowledge" and prides himself upon his dexterous use of the needle, and it is these individuals who must be carefully watched. We cannot truthfully deny that, here and there, have occurred some extraordinary racing results, and in some glaring instances of "cramp" or of the gaining or losing of time an owner, or even a member of the public, may make some wild allegation which demands an investigation. Such should unhesitatingly be undertaken on the spot, even if only to prove the falsity of the suggestion.

I have on many occasions carried this out in past years, but have always failed to find evidence of foul play. Being in ignorance of what might have been administered (if anything) or of its mode of application, it would seem very desirable to collect not only the vomit, but also a sample of saliva, urine and faeces; perhaps even blood.

Results of analysis may depend upon the period of time which has elapsed between the administration of the drug and the

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moment of procuring specimens, because the time of elimination, *via* the several channels, varies. Adrenalin, for instance, would have been oxidised after about five minutes, whilst strychnine, being cumulative, would be found days after.

Chemical Agents

There are numerous causes of tetany from toxin or drug, though most of them may be dismissed as playing no part in this review. But tetany caused by nearly all of them occurs in paroxysms which may last a few seconds or an hour or more, and do not necessarily follow great exertion.

A. *Strychnine* comes first to mind; yet at first sight one would think it could soon be dismissed as a cause of "cramp" following racing, since the spasms would affect the muscles of the whole body rather than be confined to the hindquarters; they would not occur just once, but would be recurrent, and they would be clonic rather than tonic. This is true, certainly, of toxic doses; it has to be considered, however, whether one full dose given prior to racing might not occasion increased muscular effort (as it was, of course, intended to do). The greater proportion of such muscular effort would naturally fall upon the hind-limb muscles, which could conceivably become "cramped" in consequence. Furthermore, the extensor muscles being more powerful than the flexors, would be expected to be mostly affected. For this reason also one might expect some degree of opisthotonos to be present during the attack, excepting, of course, the fact that the extensors of the neck would not have been subjected to severe work as were those of the hind limbs. To elucidate this theory a series of tests would need to be undertaken. Strychnine is a stimulant to the spinal cord and respiratory centre, but has no direct action on the heart, and there is no doubt that Easton's Syrup is regarded with great favour among trainers for its tonic and energising effects. I heard of one case in which an over-ardent "know-all," thinking to assure his dog's chance, administered a "good big dose" of Easton's Syrup just prior to a race. The dog was dead within five minutes.

B. *Digitalin.*—It has been suggested that a prolonged course of digitalis will produce symptoms of "cramp" upon exertion, but I personally have never observed or heard of an authentic case. Reference to works on toxicology reveals no mention of muscular symptoms in chronic digitalis poisoning.

C. *Cocaine.*—Cocaine is a stimulant, tonic and restorative, increasing mental alertness and muscular power and removing fatigue. These effects are well known, and there is no doubt that many racing dogs have received it, though with what practical effect I am unaware. But cocaine is a protoplasmic poison, and among its toxic symptoms are muscular twitchings and convulsions, loss of co-ordination and equilibrium, great excitement and salivation. I am unaware that a single attack of hind-limb rigidity could be a feature, and I greatly doubt it.

D. *Arsenic.*—Arsenic is a substance sometimes used by trainers as a skin, blood and general tonic, and I have met those who have felt sure that the cumulative effects of arsenical salts were responsible for "cramp." But this opinion seems negatived by the fact that "cramp" (although occurring in humans suffering from chronic arsenical poisoning) is not the foremost symptom, and would in any case be accompanied by other striking symptoms such as vomiting, purgation and colic. Furthermore, the onset of the "cramp" would not necessarily synchronise with the act of racing, but would appear sporadically.

E. *Thyroid Extract.*—Occasionally this is used to reduce to leaner proportions animals which are considered too fat for successful racing. There have been many reports that continued administration of thyroid preparations, in large amounts, have led to (among other symptoms) muscular weakness, especially of the hind extremities. Yet there seem to be no reports in the literature of such muscular weakness culminating in actual tonic rigidity after exertion.

On the other hand, it is also known that hypothyroidism may itself cause tetany, though this symptom would not manifest itself in one lone attack, but in paroxysms.

F. *Adrenalin.*—Under the influence of emotion, great muscular effort, fright, etc., the adrenals pour out an excessive secretion which "tunes up" the muscles for extra effort and makes available an increased amount of glycogen for their use. Some individuals are notoriously devoid of this natural stimulus, and it might seem at first sight that to administer adrenalin before racing would result in affording just that extra effort necessary to win. Given by the mouth, however, we find that adrenalin is largely destroyed in the duodenum and exerts little effect. Given subcutaneously it has no general action (producing only a local ischaemia) except in large doses, and if too large there would follow prostration, collapse and paralysis of the central nervous system. Rather more general stimulant action would follow intramuscular injection, but the best result would accrue from intravenous administration. By this means there would be a rise in blood pressure and an increased efficiency of the heart. These effects are, however, transient, and adrenalin does not act upon contractile muscle itself. So that it would appear that from the difficulties of administration, and the time factor, adrenalin will be of little avail to the crook.

G. *Ephedrine*, on the other hand, may be given by mouth and exerts similar effects to those of adrenalin, though of much longer duration.

H. *Benzedrine* (officially known as amphetamine) is a substance which has gained world-wide notoriety on account of its power of quick stimulation for all who are called upon to undertake an extra effort. I am quite in the dark as to whether it has or not been used upon the racing greyhound; in what dosage or with what effect. Maybe somebody present will be able to enlighten us.

Other Causes

So much for chemical agents. Consider now

4. Dehydration.—In the human, what is termed "heat cramp" has been observed affecting those who work in great temperatures, such as boiler rooms, kitchens, etc. Dr. Pritchard, of University College Hospital, says that "the clinical and chemical changes suggest that they are due to the lowering of the sodium chloride in the serum, which results from loss in the sweat without adequate replacement. The "cramp" occurs when these substances decrease to a critical level, which is itself a function of individual susceptibility, of acclimatisation, and of intensity of work."

Then we also know that "cramp" may follow bouts of alcoholism, due to the continuous loss of fluid by vomiting. It is, however, very improbable that dehydration can ever be held responsible for "cramp" in racing greyhounds.

5. Sodium Chloride Deficiency.—There is a widespread belief that deficiency of this salt in the blood can lead to attacks of "cramp," yet the authority on neurology quoted above states that "there is no satisfactory evidence that deficiency of NaCl can give rise to hyperexcitability and persistent over-activity of the lower motor neurone, of the neuro-muscular junction tissue, or of the muscle fibre. In any case, it seems more likely that the sodium chloride deficiency is only an indication of more widespread disturbances of salt metabolism and that it is not a lessening in the amount of this particular salt, but an associated change in the amount of potassium or of some other base, which is immediately responsible for these neuro-muscular symptoms."

6. Occupational "Cramp."—It is well known how certain craftsmen, such as writers, tailors, musicians or gold beaters (who use precisely the same muscles again and again, for the same work), may become affected with "cramp." Such attacks are characterised by a stiffening of the muscles—at first of those over-exercised in the acts concerned; later of neighbouring muscles, and finally of all the muscles of the limb. This persistent contraction of the muscles is invariably uncomfortable and may, in the human, be severely painful. Can "cramp" in the racing greyhound be looked upon as an occupational disease? Certainly the same set of muscles are used throughout in the act of galloping, and these are the ones which become fatigued and rigid.

7. Myotonia.—The name myotonia describes a tendency for the muscles taking part in voluntary movement to remain fixed in a state of contraction from which they can only gradually be voluntarily relaxed. When it affects the legs, these become rigid so that they cannot be flexed. This symptom is always more apparent in cold weather; and it can in many ways be satisfactorily regarded as due to a failure of adaptation of the muscle fibre (such as may be experimentally induced to some extent by a shortage of calcium). This muscle spasm cannot be cut short by any effort of will, and is, therefore, a form of "cramp." Although uncomfortable, it is rarely painful.

Myotonia of the human, as thus described in medical literature, seems to afford a fairly true picture of what occurs in the racing greyhound and we have, therefore, to conjecture whether, in such a case, we are dealing with a calcium deficiency.

We do, at least, know that calcium deficiency in the cow will cause tetany.

8. Cold.—There is no doubt that the exposure of greyhounds to intense cold is inducive to "cramp." This breed of dog feels the cold acutely: one can often see them shivering vigorously on only moderately cold days. Greyhounds occupying very cold kennels would certainly be more likely to exhibit "cramp" than others not so uncomfortably housed. In the winter months of racing, when race days are marked by biting north-east winds, the group which is about to race is paraded slowly around the course, feeling the cold intensely, and becomes more susceptible to "cramp"—especially if there is any other predisposing cause present. What is the explanation of "cramp" attacking swimmers? Is it the cold water or the fatigue?

9. Miscellaneous.—Among miscellaneous causes of "cramp" or rigidity in the human being may be mentioned digestive derangements, rheumatism, nephritis, etc.; conditions which have been observed to favour the onset of spasmodic "cramp" not in any way connected with exercise. So far as the racing-fit greyhound is concerned, these causes can probably be ruled out.

In hysteria, rigidity of one or more muscles may suddenly follow an emotional storm, but it rarely lasts long. It is very doubtful whether the emotion alone, as produced by racing, would ever be responsible, in a dog, for "cramp."

Quite frequently, in private practice, we see cases of paralytic rigidity of the hind limbs, which have occurred very suddenly—and quite unconnected with violent exercise or emotion. This rigidity passes off but slowly, taking possibly 7 to 14 days in the process. There appears little doubt that this type is caused by pressure on the spinal nerve roots following haemorrhage. Only upon resorption of the clot does the rigidity pass off—purgatives expediting the process. Obviously, however, in view of its rapid termination, the rigidity occurring during racing is not due to haemorrhage.

It is pertinent to note that there is a marked resemblance in some respects between "cramp" of the dog and azoturia of the horse, with one exception, and that is the absence in the dog of urinary changes: at least any such changes which might actually have occurred have not been observed.

The characteristics of azoturia are that:—

1. It is associated with a period of idleness. (Can the racing dog have been kennelled too long prior to racing?)
2. It occurs on being put to sudden work.
3. Most commonly met with after spells of frost or, at least, in cold weather.
4. The hind limbs become rigid, the animal staggers, and the fetlocks knuckle over. (True also in the dog.)
5. Symptoms soon pass off with rest and treatment.

All these points are observed in the dog, hence the similarity, and there may be some factor at work (as yet undiscovered) which can produce like symptoms in each species under similar circumstances. In azoturia, the severity of the attack is in direct ratio to the amount of albumen in the urine; and, although I am unaware of it, the dog's urine, too, may exhibit some degree of albuminuria. This is a matter for further investigation.

Vitamin B.—Curiously enough, at the May meeting of the "Central" when canine dietary was being discussed, one of the openers (Dr. Muir, of the Royal Veterinary College) essayed the opinion that deficiency of vitamin B_1 could well be a "cramp"-producing factor. He explained that there was an absolute necessity for vitamin B_1 for the oxidation and removal from the tissues of lactic and pyruvic acids, both of which are intermediate products of carbohydrate metabolism. It appears that the physiological function of vitamin B_1 is undoubtedly associated with carbohydrate metabolism, and that, in combination with phosphoric acid, the vitamin forms an ester which has the properties of an enzyme, and takes an essential part in the oxidation of carbohydrates in the body. In the absence of vitamin B_1 the oxidation of carbohydrate is incomplete and pyruvic and lactic acids accumulate in the tissues which—in consequence—lose their power to take up oxygen.

Reasoning this out further, can it be that the greyhound which has an excess of carbohydrate in its diet will become more prone to "cramp" on account of the greater demand set up for vitamin B_1, which demand may not be satisfied? As already explained under paragraph 1 of this paper, the *actual* cause of fatigue is this accumulation in the tissues of sarcolactic acid. Now you see that it is essential to have vitamin B_1 present in adequate proportion in order to remove it.

I have related all the actual and predisposing causes of "cramp" which, so far as my knowledge goes, could possibly operate in the racing greyhound, and it now remains to summarise, and to arrive—if possible—at some conclusion. It would appear that the most likely cause of racing "cramp" is genuine fatigue due to insufficient regular and progressive exercise. Where the condition crops up indiscriminately in a number of dogs all trained by one man (as I have seen it do), it points to *bad* training in probably every aspect—including dietary. As the method of preparing food in a training compound is a mass method, it could easily happen that the diet, as fed to all the dogs, is deficient in vitamin B_1 and, therefore, the products of muscle activity (the pyruvic and lactic acids) are not removed, fatigue and "cramp" resulting.

When one particular dog habitually "cramps-up" practically every time it runs, the indication here is cardiac deficiency. There are, of course, many greyhounds which—as a result of distemper or for some other reason—have myocardial or valvular deficiencies; and no one can expect excessive strain to be borne by a weak heart.

The other causes, such as deficiencies of blood calcium, sodium chloride or vitamins; the presence of chemical or other toxins; cold weather, etc., will undoubtedly operate in some individual cases; and if we attach any importance to the suggestion that greyhound "cramp" is an "occupational cramp" we find that this is only a fatigue "cramp"—the fatigue of one muscle or of one group of excessively worked muscles.

So far as malpractices are concerned, it seems that such can only be admitted or entirely ruled out by veterinary track officials holding a conference to decide (1) which toxin or drug is capable of causing "cramp"; (2) how such agents can be detected, in order that guilt may be attached to the responsible party. Such investigation would entail experimental administration of selected substances followed by trial racing—and the observation of results.

. . . . .

Discussion

The discussion was opened by Mr. J. D. Fulton, who said that, firstly, he must thank Major Kirk for giving him that opportunity. Secondly, it happened that a particularly bad case of "cramp" occurred at the track that he officiated at and that Major Kirk happened to spend his "busman's holiday" there. It was this case that more or less was responsible for the writing of this paper. Here was a case of a really fit (but excitable) dog, racing in an open event. This dog raced for, say, 150 yards, began to totter and, after perhaps a similar distance had been covered, absolutely collapsed—and was carried off the track. The dog was unconscious and the "cramp" affected all his muscles and not solely the hindquarters, as was more or less what one found in the majority of cases. The condition remained with the dog for quite half an hour. This, he said, was unusual as the spasms pass off very quickly. He suggested not running the dog again as he felt sure that he was a "heart-y subject." However, the dog *was* given a trial after a month's rest. It ran perfectly and no ill effects were noticed. It was taken back to the kennels, but the following morning was found dead. One met with more cases in the cold and wintry weather than in the summer, and this year, from January to April, he had some 14 cases—(all in fit dogs)—an average of one case per meeting.

Major Kirk had mentioned fatigue as one of the causes. Mr. Fulton said he had asked his kennel manager, a man of excellent experience and well known to the greyhound world, what he thought and had observed about the class of dog subject to "cramp." His opinion was that it invariably occurred in excitable barking and jumping up and down by dogs put in the kennel previous to racing. With this class of dog they had tied him up until ready for racing. Did this jumping up and down business cause fatigue—or did it cause strain on the heart? The essayist had also mentioned "azoturia." He, Mr. Fulton, could not help thinking that "cramp" in the dog was similar in many ways, especially in the winter, due to lack of normal exercise and then suddenly getting a gallop. He had never drawn any of the urine from a dog to see if there was any discoloration as was shown in azoturia. Some members present had great experience in racehorses, and he would like to hear from these gentlemen if they had a similar "crampy" condition in these animals, or was it a true azoturia? He had never, to his knowledge, had any tricks played with drugs at this particular track, so would say nothing about drugs as a cause.

Mr. J. K. Bateman, who followed, said that the subject of "cramp" in the racing greyhound was one which used to be of much greater importance than it was to-day. The primary reason for its less frequent appearance was undoubtedly the lessening of the interval between kennelling time and the time of racing. As he had said before, there were many dogs which took "cramp" when racing which did not take it when they were not subjected to a wait in a racing kennel. Without a doubt there was a definite physiological reason for the appearance of "cramp," though it was possible to recognise several different types of the malady. He recognised the following types:—

(1) The "cramp" which occurred in the unfit dog.
(2) The "cramp" which occurred owing to weather temperatures—usually cold.
(3) The "cramp" which occurred in a certain nervous, fretting type of dog and which could be seen every time the dog was subjected to waiting before racing.
(4) The type which occurred in dogs which had been doped.

Before examining these types in detail let them examine the manifestation of symptoms in the human being who was subject to the malady. The man who "cramped" in the cold water did so, in his opinion, because the temperature was such that the arterioles and small veins in certain areas of his body were so constricted that they were unable to remove the carbonic and lactic acid waste products from those areas. The presence of these waste products stimulated the nerve terminals and such stimulation in turn caused a muscle, or groups of muscles, to contract. The application of, first, gentle and then vigorous, massage increased the circulation, removed the stimuli, and relaxed the muscle. If this theory was correct then it opened the door for them to examine the appearance of "cramp" in every type he had enumerated.

In type (1) "cramp" was due to unfit groups of muscles—muscles which had not been brought up to that state of tone which allowed them to function at speed, and their blood vessels to remove quickly the excess of waste products collecting in the area from lack of muscular condition.

Type (2) he had dealt with above, but here let him add that heat alone did not appear to be a cause of "cramp." "Cramp" occurred in hot weather in conjunction with unfitness or nervousness.

Type (3) was the common type and that which occurred as a result of nervousness alone. He had spoken of this type in a general way at their May meeting and, as their friend Dr. Tom Hare said to him later, he was probably the first to attempt to treat the mind of the dog. Now there did not want to be any ambiguity about this type and its occurrence. Those of them whose business it was to see the greyhound regularly *all* recognised the dog which was a "cramp" subject. "Training" treatment by the trainer could postpone the onset of the symptoms. The dog usually did not take it when sent for a trial without a waiting period but if deprived of his breakfast and a sufficiency of exercise that morning the combination of the mental effect of the former and the physiological state of the latter might be sufficient to set up the condition. As it appeared to the veterinary surgeon in charge, the dog was not unfit to race when he came out of the racing kennel to take his part in programmes. He might or might not have salivated in his kennel but he had undoubtedly reached a state of mental exhaustion and was relieved to be out in the fresh air. In appearance, this passed off, but time was short and the later the race was in the programme the longer the time that would be required for him to attain his pre-kennelling state of fitness. At the tracks which he attended, the dogs had about 15 or 16 minutes between leaving their kennels and joining in the race and during this time they walked some 600 yards or more. It

was soon learned that only in the interval between the first two races or between races 2 and 3 was this a sufficient time. It was insufficient in the later races (and sometimes in earlier ones, too) because the effect of pent-up excitement in the kennelled dog plus the absence of any excretion had so collected waste products in his muscular system that nothing short of a few quick gallops, plus the freedom to breathe freely and evacuate his bowel and bladder, would set his muscles in a state of sufficient tone to function perfectly over 500 to 600 yards fast gallop.

Many of them had watched the human sprinter, the trotting horse or the race-horse doing preliminary exercises, probably without realising that the perspiration which ensued precluded all possibility of "cramp." The dog, however, had no such opportunity, but here he might say that some dogs might be prevented from "cramping" in an afternoon by being galloped freely in the forenoon. He had tried many remedies for the condition but only when he tackled the problem from the aspect of the state of mind of the dog did he get any measure of success and the only two "cramp" cases which had come his way recently had apparently recovered after his treatment.

Such treatment, in the hands of unscrupulous people, might be dangerous but he quite confidently advised any of the profession who were interested to give it a trial. That care was necessary was evident from the fact that doping could apparently lead to the onset of "cramp" symptoms type (4). It might be, however, that many of the so-called "dopes" did not merely act on the central nervous system but, by reason of their composition, broke down into constituents which increased the H-ion concentration of the blood. His theory, in a few words, was that greyhound "cramp" was due to the increase of the H-ion concentration of the blood and was localised in those areas of greatest muscular development —the shoulder and thigh muscles. That it could be overcome in the various types which occurred in the greyhound by the attainment of physical fitness, by massage or friction to those muscular areas to allay the effect of cold, by lessening the mental excitement of the animal when the pre-racing period could be shortened and by the prevention of doping. Further, that they met the condition more commonly in the dog, because he was not fitted by Nature with the apparatus for rapid elimination of excess waste products (sweat glands) and also because they did not allow prospective runners a preliminary canter. This was, of course, impossible because of the attendant risk of injury with subsequent inability to take part in the race.

He had purposely omitted all reference to heart affections as a cause of "cramp." Though one met many cases of irregular heart beats, weak pulses, etc., he had never been able to connect such cases with "cramp" and it was a fact that the dog which dropped dead after a race with heart trouble did not show any evidence of "cramp" before falling dead but usually ran his race fully out.

Mr. J. L. Cormack thanked Major Kirk for having brought forward a subject which was of great concern to every veterinary surgeon who had any experience at all on greyhound racing tracks. At the track with which he was connected "cramp" had occurred comparatively rarely, and the majority of cases happened on a very cold day with a biting wind. If the start of the races had been held up, the dogs were standing around waiting to be admitted to the trap, and it was on such occasions that he had had cases. In his experience "cramp" occurred most frequently in older dogs that had been racing over a period of years—the animal might have been suffering from chronic nephritis, and in animals of this type he often advised that the dog should be retired from racing.

In the matter of the malicious administration of drugs, he understood that some of the dope fiends used some quite well-known drugs, such as aspirin, the use of which would probably produce "cramp." This was administered to, say, five out of the six dogs running, one being left alone.

Mr. A. Sams stated that, from experience at Wimbledon, he should say that 80 per cent. of cases in "cramp" had occurred in dogs having their first trials, following their return to the kennels after a period of rest and, in his view, in the majority of cases it was a question of condition. He was of the opinion that the drugs, about which they heard so much, did not cause "cramp." The procedure he adopted was to put the dog through the shorter distances first and then gradually to increase them to the distance required for racing.

Mr. K. J. D. Evans expressed agreement with Mr. Bateman's view that "cramp" was seen quite as frequently in the forelegs as in the hind—also along the back in many cases. He was in agreement with him also that the affected animal did show a certain amount of pain, which seemed to go after a short time. He had found quite a few cases to occur as a result of the dog being subjected to a bad bump at one of the bends. It seemed that a certain amount of inco-ordination of the muscles did predispose to "cramp" in certain cases. He had found that if dogs that had been liable to "cramp" were massaged before they went on to the track, it would help to a great degree. He agreed with the gradual increase of the length of the gallop.

Mr. J. J. Davies observed that, to a large extent, he agreed with what had been said, namely, that a dog not in condition would develop "cramp," as also would the over-conditioned dog: of course the heart case would do so. He had proved, however, that dogs that had been interfered with would go down with "cramp." He was associated with two tracks: in one they had constantly to contend with "cramp," but, in the other, they had not had a case for three years. At the latter track the dogs were fed far more meat and there might be something in the vitamin B_1 theory. On one occasion, when two dogs in a race developed "cramp," they were made to vomit and each brought up a quart of soup-like liquid; this was analysed, and the report was that it had contained laudanum and an excessive quantity of salt. As a result of that, the whole staff were cleared out, and since then in every case of "cramp" the vomit had been examined chemically. In one case he took a sample of the vomit and the next day the dog was ill and developed symptoms of distemper, but the report was that there was morphia in the sample: doubtless that was a case of coincidence. If a dog was in good condition and got "cramp," he was always suspicious that the animal had been interfered with.

Mr. Scott Dunn stated that he had been connected with a stadium for 15 years and there was a very good feeling existing between the directors, the staff and himself. He had been given a free hand in all veterinary matters. He had taken many stomach samples following on "cramp," but analysis had always proved negative. In his experience "cramp" had generally been noticed in dogs which had been kennelled for some time. He did not agree with the suggested similarity between azoturia in the horse and "cramp" in the dog, because the latter condition cleared up very quickly and there was no change in the colour of the urine. Regarding "cramp" being caused by heart trouble, if this was so it was very necessary to examine the dog, not at the time of racing but when the dog was quiet.

Mr. B. O. E. Walpole, who congratulated Major Kirk on a very fine paper, said that he had one particular case in mind. It occurred about two years ago, the greyhound concerned being usually seized with "cramp" at the same place round the course. He could not quite understand the reason and he thought there might be something wrong in the history of the animal. He would like to know whether there was any hereditary predisposition to "cramp." He had never known "cramp" to occur before racing: the chief trouble he had had in connection with this condition was when the dogs had been conveyed by van; the confinement of dogs in the kennels and their subsequent conveyance in that manner might have been a factor in the particular case of "cramp" he had in mind.

Mrs. O. E. Evans said that she, being associated with three tracks, had naturally met with cases of "cramp." She had found them to occur mainly during the close season.

Mr. W. R. Muir stated that he, himself, had no experience of "cramp" in the dog, but the remarks of previous speakers indicated that very different opinions were held as to the cause of "cramp" and it seemed that the condition called for biochemical and physiological research. Although "cramp" might be precipitated by a number of different causes, it was likely that these all operated through one final mechanism such as the excessive accumulation of products of muscle metabolism, among which lactic acid might be important. The production and disposal of these metabolic products was dependent upon the blood supply to the muscle and upon the concentration of specific substances (enzymes and co-enzymes), which regulated the chemical changes in muscle during contraction. Vitamin B_1 (which was a component of one of these co-enzymes) was essential for the disposal of pyruvic and lactic acids by oxidation and therefore the dietary supply of this vitamin might well be one factor determining susceptibility to "cramp" and to fatigue in particular. Training, environmental temperature, excitement and activity before a race were factors directly or indirectly influencing the circulatory system and the blood supply to the muscles. In this way the various opinions as to the cause of "cramp" might be reconciled. He would certainly welcome an opportunity to investigate the condition in co-operation with the essayist and other veterinary surgeons concerned.

Dr. Tom Hare observed that none of the speakers reported any pathological investigations of "cramp" in the greyhound. Infection of any kind should be eliminated as a cause with laboratory collaboration. Some light might be thrown on the physiological aspect by reference to the "cramp" of egg-binding, which occurred in birds and was defined originally by the late Mr. Henry Gray about 30 odd years ago. This was an obstruction of the distal third of the oviduct by a fully formed egg owing to "cramp" of the plain muscle fibres of the oviduct. The condition, if taken early, was relieved by the application of heat. It had been noted in many species of birds that this condition occurred in the early stages of egg-laying, when the bird was exposed to a chilling current of air. Chill, he was sure, was not the whole story, because egg-binding also occurred in birds which were suffering from infectious disease or from excessive adiposity.

A suggestion might be put up to the Greyhound Racing Association that research should be prosecuted into this problem of racing greyhounds.

Dr. J. T. Edwards said that he had listened with interest to the fascinating topic under discussion, for the reason that from contributions made by the various speakers he had been curious to find out in what respects "cramp" in the racing greyhound corresponded with similar conditions described in other species. Major Kirk, in his admirable recital of his own clinical experience and his review of the existing literature, had expressed the view that the condition was very similar to equine haemoglobinuria, and had mentioned that it was strange that "cramp" did not occur in thoroughbred racehorses in this country, even though one would suppose them to be subject to the same stresses, both physiological and psychological, as racing greyhounds. At the last meeting, the question of the feeding of dogs was under discussion and he (Dr. Edwards) mentioned then how one was able sometimes to obtain some light on disease conditions in this country from observations upon them as they occurred, often in a different form, in other countries. When he was in India, he was consulted about a condition in racehorses, which, he was assured, if he could elucidate it, would make his fortune, namely, a condition which occurred among racehorses called "non-sweating disease." This condition was observed to come on suddenly in the course of racing during the hot weather, and the symptoms were somewhat similar to those described by Major Kirk, but the outstanding characteristic was the inability of the horse to sweat. The horse recovered spontaneously if he were transferred to another environment, where the temperature was lower. He had been rather wondering whether there was some connection between that condition, of the causation of which nothing seemed to be known, and the condition described by Major Kirk and the other speakers.

The essayist had referred to a condition well known in the human subject, namely, heat "cramp." This was a condition which came on at the beginning of the warmer periods of the year amongst workers engaged at high temperatures. In a way, that resembled the "non-sweating disease." There was a tremendous loss of sodium chloride, an increase of blood cell volume and serum proteins, and the condition could be cured by adaptation of proper food and exercise and by one specific prophylactic, the taking by the mouth of sodium chloride, or its injection intravenously. Was that analogous to the condition in the dog? It might be in part, because they had not heard that afternoon any data in regard to the biochemistry of that condition, which seemed to need badly to be worked out. Mr. Bateman assured them that the condition was not cured by the administration of sodium chloride, however. The other condition, which was well known in animals, and also to have some definite causation, was tetany. Tetany was associated with a drop in the calcium and magnesium. He did not know whether there was such a change in the dog, although, here again, Mr. Bateman assured them that the injection of calcium gluconate did not cure the dog. It was only to this extent that they had any of the desired information as to whether or not there was any disturbance in the concentration of the inorganic elements in the blood required to ensure stability in the neuro-muscular system.

He (the speaker) was struck by the statement made by Mr. Bateman that the condition did not arise if the dogs were kennelled for a long time. One of Pavlov's experiments in his classic work on the conditioned reflexes showed that a dog, administered apomorphine regularly, to cause vomiting, became sick, if this procedure were adopted regularly, even if apomorphine was not placed in the syringe and merely water injected, and afterwards would become sick at the mere sight of the syringe and the operator. From such experiments, it could be concluded that the dog was an extraordinarily neurotic creature and all the body mechanisms would be called into play for running a race some time before that event took place, when the dog was brought to the scene of racing; thus, even before the start of the race the dog would be fatigued.

Sir Thomas Lewis, of University College Hospital, had carried out some very interesting work on this condition of fatigue as a possible preliminary to the induction of "cramp." The effect of cold brought into play the local neuromuscular mechanisms, so that a large quantity of water might be withdrawn from the tissues; secondly, the muscles might suffer from clonication, due to ischaemia and anoxaemia, and then, in this condition Sir Thomas maintained that each time the muscle contracted there was a pain-producing factor liberated from the muscle, which, in the ordinary way with a substantial oxygen supply, was immediately destroyed, but which in this condition, with the muscles lacking tone, was not oxidised and an accumulation of this factor brought about the condition of "cramp." That seemed to be a likely cause. However, a great deal of work needed to be done before such a view could be substantiated in the case of the greyhound condition. The domesticated dog, fed as it was on an omnivorous diet or even a herbivorous diet, was far away from its ancestor, which was entirely carnivorous. In a state of nature, the dog allowed its fresh food to become partially putrid so as to offset any tendency to alkalosis, which was prone among other symptoms to bring on

"cramp" after muscular exertion, because the calcium in the blood, it had been stated, was not then present in the normal highly ionised state.

They had heard, in the speaker's opinion, a contribution to the study of comparative neurology, and there seemed to him certainly a wealth of clinical experience regarding the dog that now needed to be properly written up, so that an experimental research worker might get down to it. In other words the biochemist, neurologist and other specialist workers might well prove they had the means to help the practitioner to solve his problem.

Dr. W. R. Wooldridge (President, N.V.M.A.) said that he was of the opinion that theorising was of little value unless it was related to the fundamental factors; these were that in the greyhound an animal was made to undertake muscular work far in excess of what it was normally meant to do, and the animal had to be trained to carry out that work—the basis of the problem was, therefore, related to the physiology of muscle. The muscle cell not only contained proteins and a variety of other substances, but it also contained many enzyme systems, all of which were attuned to work in one with the other. In other words, it was a complex system in which changes were continually occurring, but in spite of that, if the muscle was properly attuned to its work, an equilibrium was maintained and accidents did not take place. Anything which upset that equilibrium, if it were pushed far enough, was likely to cause a stiffening of the muscle fibres and produce a state of "cramp." He thought the only thing they were entitled to conclude from the excellent clinical discussion was that many of the observations made would seem to be associated with metabolites such as glucose, lactic acid, proteins, etc., all of which normally participated in the complex muscular equilibrium. The corollary, of course, was that a great deal of further biochemical and physiological research was necessary, and he hoped that Mr. Muir would be given the opportunity to assist with its furtherance.

Mr. W. S. King expressed the view that nervous fatigue was one of the greatest factors in the causation of "cramp." He could see no connection between azoturia in the horse and "cramp" in the greyhound. The latter was sudden in its onset and loss of power was complete, whereas in azoturia he had found that cramp did not manifest itself for days and there was retention of some degree of power. It was not until he took the affected horse for exercise that loss of power established itself, and the further he went, the more complete the loss of power. So that he could not see any sympathy between those two conditions in the horse and greyhound respectively.

Abridged report of Reply to Discussion

Major Kirk, in replying to the points raised in the discussion, said that he would like to ask Drs. Hare and Edwards whether they thought the term "cramp" was a misnomer; he was not at all convinced it was the best term to apply to this disability. "Cramp," as he knew it in human beings, was a terrific contraction of the flexors, causing great pain, whereas in greyhounds it was mainly a tonic rigidity of the hind limbs implicating the extensors. [Dr. Edwards replied that that description conformed entirely to the definition of "cramp," which was a "painful muscular contraction which could not be relaxed at will."] Major Kirk, speaking from long experience, contended the greyhound affection was not a painful one. He had seen it occur for years, and whilst a few might have momentarily cried out (probably from the fright and the fall) most, after being picked up, showed no sign of pain.

Mr. Fulton, in his opening, had said that it was the dog excitable in the kennel which was most likely to succumb to "cramp." He (the speaker) recalled two particular dogs which were extremely excitable and poured out pools of saliva whilst kennelled preparatory to racing, and yet neither of them was ever "cramped." He could not subscribe to the view that it was chiefly excitable animals which had "cramp."

He would like to point out that practically every one of the many speakers had assigned a different cause to "cramp." Mr. Bateman contended the conditon was of nervous origin; Mr. Cormack that it was due to cold; Mr. Sams, to fatigue; Mr. Evans, to bumping; and Mr. Davis to lack of vitamins or unbalanced food. All these things, however, as Dr. Wooldridge had said, were only in the nature of predisposing causes. He had himself eliminated a number of causes and had arrived at the view that the important one was genuine fatigue.

When his racing manager wanted to know why certain dogs were having "cramp," he thought he was bound to reply that such animals had received inadequate training; though in the case of the dog which consistently "cramped" at every race meeting he would guess there was heart deficiency. Mr. Bateman gave bromides; but would not that slow the dogs' racing speed? [Mr. Bateman interjected that so far it had not done so in his experience; he gave 7½ grains a day up to 245 grains for a course of treatment and the dogs so treated had run to their time.]

Mr. Cormack had spoken of the administration of aspirin as being the cause; but actually aspirin relieved muscular spasm rather than caused it.

He (Major Kirk) had never seen the condition in the forelegs alone, and only rarely in the forelegs in coniunction with the hind. Mr. Evans had expressed the view that it was a good thing to graduate the distance run and gradually work the dogs up to the full course. He (the speaker) said this was the essence of adequate training and had been referred to in the body of his paper.

Mr. Davies had mentioned that opium might sometimes be given; it was certainly easy to do and was worth bearing in mind. Replying to Mr. Scott-Dunn, he said he had not intended seriously to uphold the theory that azoturia of the horse and "cramp" of the dog were one and the same thing. In his review of the whole subject what he had done was merely to draw attention to the several points of similarity between the two conditions, the outstanding point in both cases being that there was "cramp" or tonic muscular rigidity occurring suddenly during work. He could not answer Mr. Walpole's query as to whether or not the condition was hereditary. Mrs. Evans considered the condition occurred more during and after the close season, which was quite true. That again pointed to fatigue and such would have to be his answer, in the main, when asked as to the cause.

He honed he had interested the members in some measure. He thought they had all learned a little from the discussion—he certainly had done so, and he was gratified at the excellent attendance at this—the first greyhound paper—presented to the Central Veterinary Society.

Weekly Wisdom

All who are truly caught up in the campaign for economy must look at everything twice before casting it away, and to look at a thing twice is, more often than not, to realise that it is something seen for the first time.—"The Times."

CLINICAL COMMUNICATION

Operation for Peritoneal-Scrotal Hernia

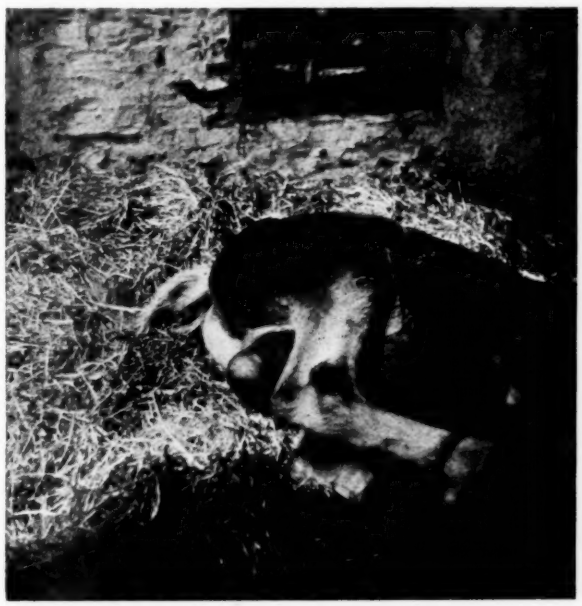
D. I. MacALLISTER, M.R.C.V.S., D.V.S.M.,
Stranraer

Peritoneal-scrotal hernia in the horse is only vaguely dealt with in textbooks on veterinary surgery. In view of this it was thought worth while to publish details of what turned out to be an entirely successful method of dealing with the condition.

Subject.—Clydesdale foal, aged three months.

Examination.—The foal was seen shortly after birth and found to have, what was then thought to be, a large scrotal hernia. The advice given the owner was that the hernia would very probably decrease as the animal got older and that surgical interference was not to be recommended.

The animal was examined at intervals. It was soon evident that the hernia was tending to increase. Further delay was considered dangerous when it was found to reach almost to the hocks and to be impossible to reduce the hernia, or to discern whether it was unilateral or bilateral. By this time the peaked "night-cap" appearance of peritoneal-scrotal hernia was in evidence.



It was now decided to operate and arrangements were accordingly made to have the foal and mare brought in to the surgery.

Restraint and Anaesthesia.—A dose of three drachms of chloral hydrate in treacle water was administered *per os*. One hour later the foal was cast by sidelines on straw and chloroform anaesthesia induced, a Cox's type muzzle being used. The animal was fixed in the dorsal position, hocks tied well apart and the hind quarters raised.

Operation.—Strict asepsis was observed, all instruments having been boiled and operating gowns, swabs and cloths sterilised in the autoclave. Cloths were clipped in position so that only the operation area was left uncovered.

On opening the scrotum on the left side, small intestine was immediately visible. Considerable searching was necessary to locate the testicle. After finding the rupture in the tunica vaginalis, the testicle was drawn out through it, the spermatic vessels ligated with 20-day catgut and the testicle removed. The cord was now pushed into the abdomen, which could be entered easily, the external inguinal ring being about 4 inches long and wide enough to allow the hand to pass through freely. After having returned the herniated intestine to the abdominal cavity, it was found that a small hernia existed on the right side also. It was decided that this was not worth interfering with as it was easily reduced by external manipulation.

Closing the Inguinal Ring.—It had been intended to attempt suturing with catgut, but this was found to be impracticable. The only course

which seemed likely to be successful was to use a clam. The tunica vaginalis could not be used, so it was decided to dissect the dartos carefully away from the skin, down to the abdominal wall. This took some time. Having achieved this, some sulphonamide was dusted in, the dartos twisted once and a stout sterilised wooden clam applied as high as possible. The excess of dartos was then removed. Three silkworm-gut sutures were inserted round the clam as a precaution against its slipping. After again dusting with sulphonamide, four tape mattress sutures were inserted through the scrotal skin, completely burying the clam. The excess of skin was not removed.

After-Treatment.—The foal was under chloroform for 90 minutes. Six hours later, after an injection of glucose, it was up and sucking.

On the third day after the operation the temperature was found to be 103·6° F. One dose of Dagenan-Soluble followed by two doses of sulphonamide reduced the temperature to normal.

The skin sutures were removed on the fourth day and the scrotum washed out daily thereafter. The mare and foal were floated home on the eleventh day. The clam was still in position on the 14th day and was then removed. The excess of skin was found to have shrunk away completely. Seen a week later, the foal was galloping about the field and was caught only with difficulty. It was obviously thriving well. When last seen the scrotal wound had completely healed and the small hernia of the right side had disappeared.

The photograph shows the foal before being operated on.

SALVAGE OF BACON AND HAM

In recent months an exceptionally large amount of bacon and ham has been condemned by inspectors of local authorities, usually owing to early decomposition. This clearly renders the article unsuitable for retail sale, though it may not justify its total condemnation if, after excision of the affected parts or re-conditioning, it can be made suitable for use in manufactured products. Instances have been reported of whole sides of bacon having been condemned outright because they were fly-blown in the blade bone pocket or in the torn tissues around the site of the aitch bone.

The salvage arrangements referred to in Part II of Circular 2640, "Unsound Food," of the Ministry of Health should already be well known to all food inspectors. The Ministry of Food has now informed the Ministry of Health that, in order to prevent delay and further decomposition, it would be glad if inspectors would get into direct touch with Area Bacon Distribution Officers as an alternative to notifying the Salvage, Food Executive or Divisional Food Officers. These Distribution Officers will themselves inform the Salvage Officer, if the inspector has not already done so. They have practical experience in the bacon trade and will be glad to help inspectors in their efforts to conserve food supplies.

The names and addresses of Area Bacon Distribution Officers are as follows:—

	'Phone:
Midland Area Central House, 75, New Street, Birmingham, 1	(Mr. R. C. Hordern) Midland B'ham 2954
North Midland Area "Overd," Cavendish Road East, The Park, Nottingham	(Mr. C. T. Gibson) Nottingham 45511
North Wales Area 65, Victoria Street, Liverpool	(Mr. W. H. Perry) Advance 7809
South Wales Area 59, Cathedral Road, Cardiff	(Mr. C. Prosser) Cardiff 8012
North Western Area 59, Victoria Street, Liverpool	(Mr. A. G. Carey) Royal 7665
South Western Area 11, Broad Plain, Bristol	(Mr. J. J. Plummer) Bristol 21162
Southern Area Rotherfield Cottage, Southcote Lane, Reading, Berks	(Mr. C. B. Burfitt) Reading 4839 & 60442
South Eastern Area Forest Road, Hawkenbury, Tunbridge Wells, Kent	(Mr. L. W. Dumper) T. Wells 2780/8
Metropolitan Police Area Egginton House, 25/28, Buckingham Gate, London, S.W.1	(Mr. A. R. Watson) Vic. 6283
Eastern Area (I) c/o Harris (Ipswich), Ltd., Hadleigh Road, Ipswich	(Mr. J. D. Holgate) Ipswich 4947
Eastern Area (II) c/o Herts & Beds Bacon Factory, Ltd., Nightingale Road, Hitchin, Herts	(Mr. W. C. Smart) Hitchin 991/2
Northern Area 66, Percy Street, Newcastle-on-Tyne, 2	(Mr. H. F. Turner) Newcastle 28051
North Eastern Area City of Leeds School, Woodhouse Lane, Leeds, 2	(Mr. J. R. Hughes) Leeds 25953
West of Scotland 93, Douglas Street, Glasgow, C.2	(Mr. J. M. Ross) Central 3632
South East of Scotland 137, Constitution Street, Leith	(Mr. J. Aikman) Leith 37039
East of Scotland c/o. Strathallon Bacon Factory, Bridge of Allan, Stirlingshire	(Mr. R. Turnbull) B. of A. 3186/7
North and North East Scotland 15, Albyn Place, Aberdeen	(Mr. J. M. Allan) Aberdeen 8801

ANNOTATION

The Pathogenesis of Tympanites in Cattle and the Various Gases Involved

Tympanites in cattle may be due to a variety of causes; in particular it is a common sequel to grazing on clover or other leguminous crops when it is known as "clover-blown" or "bloat." It is usually assumed that the condition is due to rapid fermentation in the rumen and that death is the result of excessive pressure of gas in the rumen causing respiratory and consequently heart failure. This simple explanation, however, was shown by Dougherty (1940-41) to be inadequate, but before discussing this interesting research it is relevant to consider first the normal physiology of the rumen regarding the formation and escape of gas.

Gas is formed during the fermentation of carbohydrates in the rumen and as a large proportion of the food consists of carbohydrate in one form or another the quantity of gas evolved is considerable. Bratzler and Forbes (1940) estimate that on an average between 4 and 5 per cent. of the digestible carbohydrate of the ration is converted to methane, while Ritzman and Benedict (1938) give a higher figure, 9·6 per cent. The composition of the gas in the rumen varies considerably throughout the 24 hours. Washburn and Brodie (1937) found the ratio of carbon dioxide to methane before feeding to be 1 : 1 or less; half an hour after a feed of hay, however, it was approximately 2·5 : 1 and 4 : 1 after a feed of grass. The proportion of carbon dioxide decreased until, towards the end of the 24 hour period, the ratio became approximately 1 : 1. Oxygen and hydrogen were present only in traces if at all, but nitrogen, although absent during the first few hours after feeding, appeared later and increased in amount until it formed from 30 to 60 per cent. of the total gas immediately before the next feed. The total amount of methane produced by a cow on a maintenance ration of hay amounted to 2 litres per kg. dry matter of the feed during the first 30 minutes following the cessation of feeding, and the figure fell to 0·2 litres per kg. dry matter per 30 minutes, 20 to 24 hours later. A 1,000 lb. cow on a maintenance ration of hay eats about 14 lb. of dry matter a day and as the ratio of carbon dioxide to methane immediately after feeding hay is 2·5 : 1 it can be calculated, assuming that the animal eats its ration in one feed and that gases other than methane and carbon dioxide are present only in traces, that during this period the cow produces approximately 50 litres of gas in the rumen in 30 minutes. If the calculation is based on the same premises and it is assumed that the nitrogen present enters from the outside air and is not produced in the rumen, this figure will fall to 2·5 litres in 30 minutes at the end of the 24-hour period. It is plain that large quantities of gas are formed even on a maintenance ration of hay and thus, if anything occurs to prevent or hinder the escape of gas, the rumen will rapidly become distended.

There are two routes by which gas leaves the rumen; some is directly absorbed and some passes up the oesophagus. Klein (1916) estimated that approximately one-third of the methane produced in the cow is excreted through the lungs but it is not certain that this is all produced in the rumen as some fermentation also occurs in the caecum. The amount of gas directly absorbed in the rumen probably depends on the pressure and the surface area of mucosa exposed to gas. Wester (1926) studied the eructation of gas and came to the conclusion that it usually occurred during the backward wave of contraction in the rumen and therefore was of regular occurrence since contraction of the reticulum and rumen occurs approximately once a minute. This conception is sound but other factors are also concerned, for, as Wester points out, irregularities occur and some animals apparently belch more frequently than others. This may be due partly to the fact that eructation is often inaudible but can be seen to occur by the wave of gas passing up the oesophagus and partly also because gas formation is greatest immediately after feeding and thus eructation is most noticeable at this time. Dougherty (1940-41) attempted to study the effect of increased pressure in the rumen of a cow by inflating it with air through a fistula but found that the gas rapidly escaped up the oesophagus and this was prevented only by filling the rumen with water until the cardia was below the fluid level. Eructation of gas, therefore, appears to depend on the movements of the reticulum and rumen and unless these movements are inhibited or hindered in some way gas will not accumulate provided the oesophagus is not obstructed, as in choking. Under what circumstances, then, are the movements of the reticulum and rumen disturbed?

Hoflund (1940) described chronic digestive disturbances in ruminants in which the motor activity of the whole stomach was deranged due to lesions which involved the vagi. He was able to reproduce several distinct types of disturbance by experimental section of various combinations of the branches of the abdominal

vagi. Tympanites developed when the rumen and reticulum were paralysed. The common clinical conditions which may produce this result are traumatic peritonitis with abscess formation which involves the abdominal vagi, and tuberculous enlargement of the posterior mediastinal lymphatic glands which involve or press on the thoracic vagi. Other conditions in which tympanites might develop are poisoning by drugs such as atropine or cyanide, both of which inhibit the movements of the stomach. Tympanites, however, does not develop in cyanide poisoning, possibly because cyanide inhibits bacterial activity as well as stomach movements. If a cow is " down " for any length of time, especially if lying on her right side so that the cardia is under the fluid level, then gas cannot escape and the rumen will become distended. Tympanites due to such causes is not fatal and the symptoms do not resemble bloat. Dougherty showed that simple pressure within the rumen did not produce symptoms of bloat or even any acute distress. A pressure of 90 mm. Hg above atmospheric pressure, produced by air or methane, in the rumen of a cow, only gave rise to uneasiness ; if carbon dioxide was used, however dyspnoea developed and blood analysis of the portal and jugular blood of sheep under anaesthesia showed that absorption of gas occurred from the rumen. Tracings of blood pressure showed that the only effect on the circulatory system of extreme pressures in the rumen was to produce an increase in blood pressure and in the heart rate.

Dougherty (1940-41) demonstrated that two gases, carbon monoxide and hydrogen sulphide, which occur in traces in the rumen, inhibit the movements of this organ. When introduced in sufficient quantity they are highly toxic, producing a syndrome resembling naturally occurring bloat. Carbon monoxide was present in normal animals in only small quantities (not exceeding 0·17 volumes per cent.), while hydrogen sulphide was present largely in solution in concentrations up to 0·309 c.c. in 100 c.c. of ingesta. Increasing the intra-ruminal pressure by air or methane and carbon dioxide in addition to these gases, reduced the quantity needed to produce symptoms. The evidence, however, concerning carbon monoxide is not convincing as no increase could be detected when the cow was fed clover from a pasture known to produce bloat, and in fact no correlation between feed and the content of carbon monoxide could be demonstrated. Also the concentration of gas needed to produce symptoms was in excess of that found in the rumen. According to Waksman (1927) carbon monoxide may be produced during the incomplete oxidisation of carbohydrates in manure clamps, so the possibility of its presence in the rumen is apparent, but as many soil organisms oxidise this gas to carbon dioxide it is equally probable that should any be produced in the rumen it will be converted to carbon dioxide. Dougherty mentions that if carbon monoxide is bubbled through the rumen ingesta instead of being introduced directly into the gas space on the surface, larger quantities are needed to produce symptoms. This suggests that oxidation does occur in the ingesta and makes it unlikely that carbon monoxide is produced in any quantity in the rumen.

The data regarding hydrogen sulphide were more convincing ; the concentration increased when clover was fed while symptoms were produced experimentally by concentrations which did not exceed that found in a naturally occurring case. Attempts to produce experimental bloat, however, by feeding cystine or sulphur failed as although the hydrogen sulphide concentration increased no symptoms occurred, in spite of feeding in addition cultures of hydrogen sulphide-producing bacteria isolated from the rumen. Further work on the relation of hydrogen sulphide to bloat and the demonstration of this gas in toxic concentration in naturally occurring cases is clearly necessary before definite conclusions can be drawn.

The essential factor in the production of tympanites seems to be inhibition of the movements of the reticulum and rumen. This may be caused by various conditions among which are toxic agents. If a toxic substance is produced during rapid fermentation in the rumen then tympanites will rapidly develop and the absorption of the substance will be increased with the increase of pressure ; consequently the accumulation of gas, either in the free form or mixed with the ingesta as a froth, is an essential part of a rapid syndrome such as occurs in bloat. The case for bloat being due to either hydrogen sulphide or carbon monoxide is by no means proved, but of the two gases the former appears to be the more probable agent concerned ; it is also possible that some other toxic agent is produced. The speed with which the symptoms develop, together with the negative evidence regarding distention with the normal gases of the rumen, strongly suggests that bloat is a form of poisoning. Tympanites due to other causes which are not associated with the production of a toxic substance in the rumen is not to be considered serious in itself as it is merely a symptom of some other condition.

A. T. Phillipson.

ABSTRACTS

[CHRONIC SWINE ERYSIPELAS. Holm, Griffith and Beeson. (1942.) *Vet. med.* **37**. 123-127.]

During recent years, many cases considered to be chronic forms of swine erysipelas have been observed in Idaho ; these cases have not been sequels to the acute or urticarial form of the disease, and the recognition of the true cause of the condition has often presented a difficult problem. The main symptom shown was lameness. For example, for several years, about 40 per cent. of the young swine in the herd of the University of Idaho Experiment Station have shown symptoms of lameness and these cases are now, on clinical, serological, pathological, and bacteriological grounds, thought to have been a form of chronic swine erysipelas. The lameness was sometimes transient and mild, sometimes slight and continuous, and in such cases there was little, if any, interference with the growth of the affected pigs ; there was, however, a rather more acute type, often associated with a rise in temperature and inanition, in which the joints remained swollen and painful for long periods, and the normal development of the pigs was seriously interfered with. The joints usually affected were the tarsal, carpal, and digital. Lameness was met with at all times of year, but mostly in the autumn, and seldom appeared in pigs over eight months old.

The course of infection in any particular batch of pigs could be studied by noting the titre of their blood in agglutination tests, a rise of titre often preceding arthritis. The presence of symptoms was often associated with a high titre (1 : 400), and it was noted, from observations on the Station and in " hog pools " in northern Idaho, that clinical symptoms did not agree with the agglutination test, at a titre of 1 : 50.

It seemed that carrier sows were just as important as infected land in the spread of infection. A control scheme, combining strict sanitation with the elimination of breeding animals with a blood titre of 1 : 400 or more—whether or not showing symptoms—was successful in reducing the incidence of lameness to a minimum. It is emphasised that other causes of lameness were met with, such as trauma, and brucellosis, and special precautions were also found necessary to prevent navel infection.

E. C.

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[STUDIES ON COPPER DEFICIENCY OF CATTLE (" FALLING DISEASE "). Bennetts, H. W., Harley, R., and Evans, S. T. (1942.) *Austral. vet. J.* **18**. 50-63.]

" Falling disease " is an enzootic seasonal disease of cattle, characterised by sudden death without any premonitory signs and pathologically by typical kidney lesions and haemosiderosis of the tissues. It is associated with a very low Cu status of affected animals and of the pastures. A concurrent seasonal anaemia can be prevented by feeding Cu supplements.

In a controlled experiment two cows out of seven succumbed to the disease, whilst seven cows treated with daily supplements of 100 mg. Cu as the sulphate remained healthy. Examination of the Hb and blood Cu levels over a long period showed that these values in untreated animals were lowest from July to late October, the season when deaths due to " falling disease " occur. The blood Cu and Hb levels tended to run parallel throughout the year. A sharp fall in Hb and Cu values *per se* did not necessarily give rise to the disease. There were no significant differences between the groups in respect of various other blood and urine constituents.

The pathology of the condition has been worked out in greater detail and as a result " falling disease " or " sudden death " (to give the newer terminology of the condition) is regarded as the terminal manifestation of severe Cu deficiency and not as a separate disease entity. The primary lesion is starvation atrophy of the myocardium attributed to direct and indirect effects of Cu deficiency with replacement fibrosis. Death is ascribed to ventricular fibrillation or to heart block. Comparison of the pathology of non-fatal and fatal cases of Cu deficiency shows that the only difference lies in extensive

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glomerular lesions in cases of "sudden death." Further detailed studies are in progress.

A. E.

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[NOTE ON VARIATION IN EFFICIENCY OF $CuSO_4$ AND NICOTINE SULPHATE AGAINST *HAEMONCHUS*. Gordon, H. McL., and Whitten, L. K. (1941.) *Austral. vet. J.* **17**. 172-176.]

Sheep infested with *Haemonchus contortus* were treated with copper sulphate and nicotine sulphate mixture repeated at intervals of three to four weeks. Treatment of one lot went on throughout 1939. From egg counts and faecal cultures the authors concluded that this mixture was "quite ineffective" in 71 per cent. of the sheep in one experiment, "unsuccessful" in 45 per cent. of those in another and "unsuccessful" in 26 per cent. of those in a third; but in 78 per cent. of 23 sheep in which copper and nicotine had failed, 2 ml. of carbon tetrachloride was "effective" and in the remainder the egg counts were reduced by 50–69 per cent.

The authors have found that copper and nicotine micture is highly effective against *Haemonchus contortus* if it is injected, or swallowed directly into, the abomasum; and they assume that its partial failure recorded above was due to failure of the copper sulphate to produce in some of the sheep the closure of the oesophageal groove which ensures the swallowing of the drug directly into the abomasum. They quote evidence which indicates that copper sulphate given alone immediately before other fluids fails to ensure the swallowing of fluids directly into the abomasum in 12 per cent. of sheep and may fail to do this in as many as 30 per cent. Often it repeatedly fails in the same animal.

This partial failure of copper and nicotine may therefore have the serious result that 26 to 71 per cent. of the sheep treated may still suffer from parasitic gastritis and may still carry enough worms to contaminate the pastures. They should be treated with carbon tetrachloride.

G. L.

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[REPORT OF A CASE OF TRUE LATERAL HERMAPHRODITISM IN *SUS*. Nielson, P. E. (1941.) *Anat. Rec.* **80**. 1-11. (2 plates; 8 refs.).]

An abnormal genital tract from a sow was discovered during routine food examination. On the left side there was an ovary of outwardly normal appearance, while on the right there was an undescended testis. Histological examination revealed that normal corpora lutea and follicles were present in the ovary, and that the testis was of typical cryptorchid type. There was no evidence of "ovotestis tissue" in either gonad.

Although genuine cases of hermaphroditism in pigs have been reported previously, Nielson stresses their rarity. The majority of cases which have been encountered or described are, of course, pseudo-hermaphrodites.

A. N. W.

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[REPORT ON FAILURE OF PHENOTHIAZINE AS ANTHELMINTIC AGAINST COMMON DOG NEMATODES IN AUSTRALIA. Kauzal, G. P., and Whitten, L. K. (1941.) *Austral. vet. J.* **17**. 185-187.]

Five puppies weighing 9 to 13 lb., and seven adult dogs weighing 33 to 65 lb., harboured *Trichuris*, *Ancylostoma* and ascarids. They were given single doses of 1 to 10 g., or repeated doses of 1 to 3 g., of phenothiazine in capsules, as powder or in the food. Egg counts were made by either the Stoll or the Gordon and Whitlock techniques.

Although the egg counts of all these species were at one time or another reduced considerably or slightly, the reductions appear to have been temporary only. The authors refer to Gordon's unpublished record of a similar temporary inhibition of the egg production of *Haemonchus contortus* and *Oesophagostomum columbianum*. None of the infestations was removed and *Dipylidium* in one dog was not affected. Thus the action of phenothiazine on ascarids of dogs was erratic and unsatisfactory; it was usually ineffective against *Ancylostoma caninum*; it was almost completely ineffective against *Trichuris* and *Dipylidium*. The work of earlier authors, who obtained much the same results, is quoted.

G. L.

Representatives of a number of organisations at a meeting in London have recommended the formation of the British Poultry Union.

QUESTIONS IN PARLIAMENT

Tuberculosis (Diagnosis and Treatment)

Mr. James Griffiths (on October 8th) asked the Minister of Health whether he is in a position to make any further statement on tuberculosis?

Mr. E. Brown: Yes, Sir. As the answer is rather long, I will, with permission, make a statement at the end of Questions.

Dr. Edith Summerskill: Has the Minister taken joint action with the Minister of Food, with a view to decreasing the incidence of non-pulmonary tuberculosis of bovine origin?

Later——

Mr. E. Brown: I am grateful that the committee which was appointed by the Medical Research Council at my request, has completed its report, which was published to-day. I have kept in touch with the committee and have already taken action on a number of points which are included in their recommendations. To facilitate early diagnosis we obtained priority for the supply of some 30 sets of equipment for mass radiography. We are allocating them to large centres of population where they can be used to the best advantage. In consultation with local authorities and with the assistance of an expert committee we have arranged for the training of the necessary expert staff for the operation of this equipment. Deliveries of the equipment will be gradual and arrangements for operation in the individual districts and for co-operation between authorities must be worked out in detail, but I expect that an effective start will be made in the New Year.

The extended arrangements for diagnosis will mean some increase in the need for accommodation. Additional beds are being allocated to meet this need and action is being taken to meet the needs for nursing and domestic staff. . . . . .

Where facilities for diagnosis and treatment are available it is important that those who give up work temporarily for treatment, which is in the interest of the public health no less than their own, should be able to do so without financial anxiety as to the maintenance of their dependants. Local authorities are accordingly being authorised to grant financial assistance in such cases to provide for the maintenance of the dependants and to avoid the break up of the home while the breadwinner is undergoing treatment. This assistance will be administered by the public health authorities as a part of the approved treatment under the tuberculosis scheme, and the cost incurred by them in accordance with detailed arrangements which I am now working out with their representatives will be repaid from Exchequer funds.

The Secretary of State for Scotland authorises me to say that he is making similar arrangements in Scotland.

In discussion, Dr. Summerskill: What is the right hon. Gentleman doing to reduce the incidence of non-pulmonary tuberculosis which can be traced to infected milk?

Mr. Brown: We are in touch with other Ministries concerned on this matter.

Mr. Evelyn Walkden: Are you going to take a stand on the question of the pasteurisation of milk?

Mr. David Adams: Has it been decided to pasteurise all milk, thus preventing the conveyance of milk-borne disease to the population?

Mr. Brown: I would refer my hon. Friends to the numerous answers I have given in the last year on that issue.

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Scotland: Hill Cattle (Subsidy)

Major Thornton-Kemsley asked the Secretary of State for Scotland whether he is yet in a position to announce that the scheme for encouraging by subsidy the keeping of cattle on hill grazings will be extended to include the Aberdeen-Angus breed and its crosses?

The Secretary of State for Scotland (Mr. T. Johnston): Yes, Sir. I have now decided to withdraw any restrictions on the breed of cow that can qualify for subsidy under the scheme.

Major Thornton-Kemsley: While thanking the right hon. Gentleman for his reply, may I say that it will give great satisfaction to all who are concerned with the improvement of our grazings?

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Oct. 21st.—Meeting of the Scottish Branch, N.V.M.A., at Glasgow, 2.30 p.m.
Oct. 21st.—Meeting of the Section of Comparative Medicine, Royal Society of Medicine, 1, Wimpole Street, W.1, 2.15 for 2.30 p.m.
Oct. 22nd.—Autumn Meeting of the Eastern Counties Division, N.V.M.A., at Colchester, 2 p.m.
Oct. 24th.—First Annual General Meeting of the Society of Women Veterinary Surgeons, Friends' House, Euston Road, N.W.1, 2.30 p.m.
Oct. 29th.—Meeting of the Lincolnshire and District Division, N.V.M.A., at Peterborough, 2 p.m.
Oct. 30th.—Meeting of the Yorkshire Division, N.V.M.A., at Leeds, 2.30 p.m.
Nov. 5th.—Meeting of the Central Veterinary Society at the Conway Hall, Red Lion Square, W.C.1, 2.30 p.m.

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N.V.M.A. ANNUAL MEETING, LUNCHEON AND CONFERENCE

Our next issue will be devoted mainly to publication of an extended report of the above events, held in London on September 24th and 25th. The issue will include the President's Address on "A National Animal Health Service," and reports of the Mansion House luncheon (at which the toast of "The Veterinary Profession" was proposed by Mr. Hudson, Minister of Agriculture), the Annual General Meeting, and the first day's Conference proceedings, when the subject of "The Production and Control of Meat and Milk" was considered. The remainder of a most successful series of gatherings will be dealt with in the succeeding issue.

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PERSONAL

Presentation.—At a meeting of the Ayrshire Division of the N.V.M.A. held in the Ayrshire and Galloway Hotel, Ayr, recently, Mr. David Brown, M.R.C.V.S., Kilwinning, was presented with a solid silver salver with the members' names engraved thereon, and a set of china for Mrs. Brown, as a mark of personal esteem, on the occasion of his retirement from practice.

Marriage.—Landau—Goluchoy.—On October 18th, M. Landau, M.R.C.V.S., to Miss M. Goluchoy.

Will.—Mr. John Boon Tutt, F.R.C.V.S., of Dounstead, Twyford, Winchester, who died on June 8th, left £9,215 18s. 11d. gross with net personalty £5,460 7s. 1d. He left £100 to his trustees for the upkeep and care of his dog "Sporan," during its life, and £50 to the Victoria Veterinary Benevolent Fund.

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R.C.V.S. OBITUARY

Birkett, Mrs. Barbara Gairda, 3, Pondtail Road, Fleet, Hants, only daughter of Mr. and Mrs. D. A. Johnston, of Mitcham, Surrey, wife of Holland Birkett, M.R.C.V.S. Graduated London, December 19th, 1941. Died suddenly in Fleet Hospital, October 11th, 1942; aged 24 years.

Wood, Robert Taylor, 8, Tantallon Place, Edinburgh. Graduated Edinburgh, December 23rd, 1905. Died October 4th, 1942; aged 58 years.

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HUMAN TUBERCULOSIS MORTALITY INCREASE

Need for Mass Tests and Milk Reform

A report by a committee* presided over by Lord Dawson of Penn, and issued on October 8th by the Medical Research Council, points out that to discover tuberculosis before symptoms develop the initiative for X-ray examination should pass from the patient to the doctor, and this can be effected only by mass radiography. The technique involves the use of a camera with which the image is reproduced on a photographic film, and it makes possible some 3,000 examinations a week.

Mass radiography should be applied to persons about to enter a new employment to prevent the entry of those with active pulmonary tuberculosis, and examinations should be repeated at regular intervals of factory employees, nurses and medical students, merchant seamen, etc. With early diagnosis the periods of treatment required would often be relatively short.

There has been a real increase in deaths from tuberculosis since the beginning of the war, and a disquieting feature is the increased mortality of children from tuberculous meningitis. Total deaths from tuberculosis in 1940 exceeded those in 1939 by 2,528, and in 1941 there was an increase of 516.

Factors affecting the level of tuberculosis in war-time include overcrowding, nutritional deficiencies, black-out conditions, and evacuation, particularly of town populations to the country, resulting in many children previously supplied with pasteurised milk receiving raw milk. The average quantity of milk a head needed for satisfactory nutrition is not less than three-quarters of a pint a day. The adult population has been inadequately supplied with milk during the winter.

"If all milk for human consumption were pasteurised it is no exaggeration to say that tuberculosis of bovine origin would be eliminated," the committee states. If pasteurised milk cannot be obtained it should be boiled. The pasteurisation of milk should be extended throughout the country.

* Committee on Tuberculosis in War-time (Lord Dawson, Chairman).

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THE NUTRITION SOCIETY

The committee of the Nutrition Society have requested the President of the N.V.M.A., Dr. W. R. Wooldridge, to convey an invitation to all members of the Association who are interested to attend the whole-day conference which is to be held by the Society on Trace Elements in Relation to Health, at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, on (this) Saturday, October 17th.

Following is the programme:—

11.00	Chairman's Opening Remarks.
11.10	(1) Significance of Trace Elements in Relation to Diseases of Plants and Animals. Dr. H. H. Green.
11.30	(2) Distribution of Trace Elements in Soils and Grasses. Dr. R. L. Mitchell.
11.45	(3) Copper, Zinc and Other Trace Elements in Relation to Physiological Function and Enzyme Systems. Prof. D. Keilin and Dr. T. Mann.
12.00	Discussion of Papers Nos. 1, 2 and 3.
12.20	(4) Enzootic Ataxia or "Swayback" of Lambs in England in Relation to Copper Feeding of Ewes during Pregnancy (Film with Running Commentary). Prof. T. Dalling.
12.35	(5) Cobalt and Other Trace Elements in Relation to Disease in Australasia. Sir Charles Martin.
12.50	(6) Sheep "Pining" in Britain. Dr. W. Lyle Stewart.
1.00	Discussion of Papers Nos. 4, 5 and 6.
1.15–2.15	*Interval for buffet luncheon.*
2.15	(7) Fluorine in Human Nutrition. (*a*) Biochemical Aspects. Dr. M. M. Murray. (*b*) Clinical Appreciation of Fluorine Distribution. Dr. D. C. Wilson. (*c*) Radiological Investigations. Mr. F. H. Kemp.
2.40	(8) Industrial Fluorosis of Animals in England. Mr. F. Blakemore.
2.55	Discussion of Papers Nos. 7 and 8.
3.15	(9) "Teart" of Somerset; a Molybdenosis of Farm Animals. Mr. W. S. Ferguson.
3.30	Discussion of Paper No. 9.
3.40	(10) Absorption and Excretion of Trace Elements. Dr. R. A. McCance and Miss E. M. Widdowson.
4.00	Discussion of Paper No. 10.
4.20	Chairman's Summary.
4.35	*Buffet tea.*

The chair will be taken at the morning session by Dr. J. Russell Greig, and at the afternoon session by Prof. C. R. Harington.

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THE FARMERS' CLUB

When the Farmers' Club held its first meeting, on October 6th, after completing its 100th year, the Minister of Agriculture, Mr. R. S. Hudson, attended, and telegrams of congratulation were read from three former Ministers of Agriculture—Colonel Elliot, Mr. W. S. Morrison, and Lord Addison, and from the National Farmers' Union.

Mr. Hudson said there was a great deal to be learned by discussion, and the highest compliment that could be paid to the Farmers' Club was the fact that it had been decided that one of the best ways to get modern knowledge to farmers was to establish innumerable little farmers' clubs throughout the country.

Lord Cornwallis read a paper on "War Farming and After."

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Sir Henry Dale, President of the Royal Society, has accepted the directorship of the laboratories of the Royal Institution, with the Fullerian Professorship, in succession to the late Sir William Bragg.

SCHEME FOR THE CONTROL OF DISEASES OF DAIRY CATTLE

STATEMENT SHOWING THE NUMBER OF UNDERTAKINGS NOTIFIED TO THE MINISTRY OF AGRICULTURE DURING THE WEEK ENDED OCTOBER 10TH, 1942

County	Undertakings Notified		Total Undertakings		
	During Week	Previously	Number	Number of Cattle	
				Cows	Heifers
ENGLAND					
Bedford	—	24	24	637	426
Berks	5	40	45	1,671	1,177
Bucks	1	31	32	883	636
Cambridge	—	9	9	185	92
Chester	7	219	226	8,010	2,670
Cornwall	3	—	3	44	57
Cumberland	1	20	21	645	584
Derby	5	109	114	3,510	2,082
Devon	5	77	82	1,412	899
Dorset	—	28	28	915	611
Durham	2	137	139	3,181	852
Essex	5	118	123	5,231	3,014
Gloucester	1	52	53	1,763	929
Hampshire	7	163	170	5,332	3,315
Hereford	2	13	15	256	161
Hertford	1	40	41	1,312	861
Hunts	—	5	5	148	92
Isle of Ely	—	1	1	1	8
Isle of Wight ..	—	4	4	55	15
Kent	1	63	64	1,296	776
Lancs.	7	104	111	3,244	833
Leics	3	35	38	1,061	721
Lincs (Holland) ..	—	4	4	45	11
Lincs (Kesteven) ..	—	12	12	135	80
Lincs (Lindsay) ..	1	34	35	641	263
Middlesex	—	5	5	259	122
Norfolk	4	114	118	3,489	2,309
Northants	2	41	43	1,187	955
Northumberland ..	1	38	39	1,238	625
Notts	—	54	54	1,302	674
Oxford	1	19	20	541	600
Rutland	1	6	7	123	95
Salop	4	151	155	4,950	2,319
Soke of Peterborough	—	—	—	—	—
Somerset	4	75	79	2,200	849
Staffs	8	102	110	3,419	1,688
Suffolk, East ..	2	49	51	1,315	976
Suffolk, West ..	1	25	26	495	348
Surrey	2	63	65	1,879	862
Sussex, East ..	3	89	92	2,448	1,263
Sussex, West ..	2	61	63	1,830	1,120
Warwick	1	73	74	1,970	1,286
Westmorland ..	1	15	16	422	497
Wilts	—	40	40	1,770	1,015
Worcester	1	108	109	2,395	1,200
Yorks, E.R. ..	4	33	37	706	336
Yorks, N.R. ..	1	61	62	1,286	687
Yorks, W.R. ..	7	143	150	3,863	1,332
WALES					
Anglesey	—	12	12	208	73
Brecon	—	2	2	25	9
Caernarvon ..	—	81	81	1,427	699
Cardigan	—	12	12	170	119
Carmarthen ..	3	137	140	2,641	1,374
Denbigh	1	37	38	776	379
Flint	3	66	69	1,509	721
Glamorgan	—	48	48	763	284
Merioneth	—	8	8	100	72
Monmouth	2	17	19	495	271
Montgomery ..	—	7	7	163	133
Pembroke	4	61	65	1,270	815
Radnor	—	—	—	—	—
TOTALS ..	120	3,195	3,315	90,247	47,272

Note.—Of the total 3,315 undertakings notified to date 872 are for 1 year, 196 are for 2 years, and 2,247 are for 3 years.

SCOTLAND County	Total Undertakings		
	Number	Number of Cattle	
		Cows	Heifers
Aberdeen	1	21	—
Angus	1	25	26
Argyll	1	12	4
Ayr	1	4	2
Banff	1	75	20
Inverness	1	43	49
Kirkcudbright	1	90	93
Perth	2	60	12
Wigtown	1	166	80
TOTALS	10	496	286

Note.—Of the total 10 undertakings notified to date, 3 are for 1 year, 1 is for 2 years, and 6 are for 3 years.

[Owing to heavy pressure on our space, publication of the weekly statement showing the number of undertakings notified to the Ministry of Agriculture under the scheme for the control of diseases of dairy cattle is being discontinued after this week and a monthly statement of the position substituted.]

NOTABLE HEAVY HORSE SHOW AND SALE

Messrs. Manley's Repository at Crewe presented a scene reminiscent of earlier days and illustrating the revival of the commercial horse, early this month, when many of the best geldings in England were on view at the annual show and sale of heavy draught and light lorry horses and vanners, and some of the highest prices since the beginning of the war were reached. A veterinarian attending the event writes: "The very high prize monies given naturally attracted the best animals. I measured the winner of the best light lorry horse not exceeding 16·2 and found him 16 hands and in my judgment at that height he would be unbeatable in England. He made 200 guineas, which I believe is a record for an animal of that height. He was a black gelding, 4 years of age, first-cross Shire and Clydesdale cross."

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It is perhaps not always realised that a third of the population of England and Wales live in the six largest city groups, and that over half the population lives in or near 14 urban centres. Do they realise what a relatively small proportion of our population work on or in connection with the land? Perhaps it needs a war to make them realise that they can only be fed by the efforts of agriculturists, farmers and farm workers and the gallantry of the Merchant Navy. How many of them even now really stop to think where and how the food they eat has been produced?—*Lord Cornwallis.*

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

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MASTITIS AND THE SURVEY SCHEME

Sir,—It is not too early to express an opinion on the working of the Survey Scheme as recommended for mastitis, as most practitioners will have seen more cases in the last three months than in the previous nine months all together. Like Mr. Chester, I have had no success, and I think I have carried out the treatment to the full. I expect laboratory workers will tell us that we are working with the wrong form of mastitis for this treatment, but how to remedy that I do not know: so many of us are situated so far from laboratories that were we to submit samples and await instructions many cows would be dead and many others past repair before we started treatment.

Mr. Chester speaks of "summer" mastitis in dry cows. It has always been my experience to find it in laying-off calvers, but this year the disease has been most common in cows in full milk. Following is a typical instance of this. In a dairy of 28 cows, all in-milk, nine have developed acute mastitis. Two were dead from gangrene in less than 24 hours; of the remaining seven I doubt if there is one that could be guaranteed correct in her udder to-day. I have always contended that "summer" mastitis, or "autumn bag" as it is called in many districts, is not primarily an udder disease at all. So many cases are seen with serious constitutional disturbance and little or no udder trouble present. Then there is the maiden heifer that can die from it long before there is any indication of the functioning of the udder. Like others, I have found that in many cases sulphanilamide reduces temperature, but in all treatments is this to be desired? I always have more hope for the recovery of an animal showing a temperature than for that of one showing the same clinical symptoms with a normal or nearly normal temperature.

I do not wish to belittle the Survey scheme as I think it a good work and a credit to the Committee, but I always have looked on this ordering of the treatment as an insult in a disease like mastitis. The various critics of the scheme are interesting but most confusing. One says he knows a better cure but will carry out the Survey cure from loyalty. Another says the scheme is no use either to him or his client, but still keeps advising his clients to enter it. For the most part my clients expect too much: many of them have got the idea from reading Press reports that we have found cures for all four diseases.

Yours faithfully,

Boroughbridge, York. WM. A. CAMPBELL.

October 3rd, 1942.

[It is in the veterinary surgeon's own hands to prevent his clients getting an exaggerated idea of what is promised. See modified C.S.2.—*Editor.*]